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Journal of the Society of Arts.

FRIDAY, FEBRUARY 13, 1857.

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NOTICE TO MEMBERS.

Members who have not received their cards of invitation to the Society's CONVERSAZIONE of Saturday, the 21st instant, are requested to inform the Secretary, who will forward the cards immediately.

EXAMINATION PRIZE FUND.

The following donations have been made since the last announcement:—

Alderman Challis, M.P.	£5 0
Charles Ratcliff, Esq., (annual)	10 10

EXAMINATIONS.

The Secretary having from time to time received letters asking for further information on several points in connection with the ensuing examinations, which seemed either doubtful or obscure, the Council are of opinion, that, when the questions involve points of general interest, the replies should be given publicly, for the benefit of all, in the columns of the Journal.

To the Secretary of the Society of Arts.

Sir,—We are busily occupied in preparing for the examination in June, but are in some difficulty to decide what books we shall use for reading the subjects of "Geology" and "History from 1603 to 1688."

The Examiners, in their printed instructions, recommend several works on each subject, but these we cannot procure without purchase, and this we could not afford. I fear, under these circumstances, it will not be in our power to procure more than one good work on this subject, and I should feel much obliged if you could assist us in making a selection.

I remain, &c.,

* * *

(Reply.)

Society of Arts, Adelphi, London, Feb. 9, 1857.

Sir,—I am instructed by the Board of Examiners of the Society of Arts in reply to your inquiry, to state that the Examiners, in recommending certain text-books as eligible Manuals of Study, did not by any means wish it to be implied that all these books were to be read. They serve rather to show how much and what kind of knowledge will be required at the Society's examinations.

In the Examiners' report, under the head "Geography," the first book named in the list, Mrs. Somerville's Physical Geography, contains, probably, as much geology as the Examiners will require, and for English History, Hallam's Constitutional History will be amply sufficient.

I am, &c.,

P. LE NEVE FOSTER, Secretary.

To the Secretary of the Society of Arts.

* * * Mechanics' Institution, Jan. 30, 1857.

Sir,—Would you kindly inform me where members of the Institute, who are desirous of offering themselves for examination before the Society of Arts at Huddersfield in June next, are to undergo their preliminary examination, and could you, at the same time, supply me with printed forms which candidates are required to fill up and forward to the Society of Arts.

I am, &c. * * *

(Reply.)

Society of Arts, Adelphi, London, Feb. 9, 1857.

Sir,—I am directed by the Council of the Society of Arts to state, for your information and for that of others, that while the Council attach the highest importance to the due organisation of the preliminary local examinations and their energetic working out, yet they have no authority to interfere either in their general arrangements, or in their several details. These are matters which exclusively belong to the local authorities or to combinations of the authorities of groups of Institutions in the same district.

While the Council of the Society of Arts stand aloof from any interference with the local management in the matter of the preliminary examinations, they will watch with lively interest the development of the principle, because they believe that on the amount of local sympathy thus elicited, and the cordial co-operation secured, will, in a great measure, depend the ultimate success of the Society's scheme of National Examination.

The Candidates' "forms of application to be examined" are now ready for delivery, and the number required (one for each candidate) will be transmitted by me on receiving a written application from the *Secretary* of any Mechanics' Institution, or *Principal* of a School, in union with the Society of Arts.

I am, &c.,

P. LE NEVE FOSTER, Secretary.

To ————

TENTH ORDINARY MEETING.

Wednesday, Feb. 11, 1857.

The Tenth Ordinary Meeting of the One Hundred and Third Session was held on Wednesday, the 11th inst., Thomas Webster, Esq., F.R.S., in the chair.

The following Candidates were balloted for, and duly elected members of the Society:—

Mackinnon, Commander Lauchlan B., R.N.
Plummer, Robert, jun.
Sanceau, Isidore Eugene
Stanton, William
Swan, Michael
Thomson, Robert
Vigers, Francis
Weguelin, Thomas Matthias.

The Paper read was:—

ON THE APPLICATION OF RAILS FOR HORSE TRANSIT IN THE STREETS AND ENVIRONS OF LONDON, AND ALSO FOR RAILWAY BRANCHES.

By W. Bridges Adams.

Facility of transit may be taken as a convertible term for civilisation. The earliest and cheapest transit being by water, the earliest settlements of mankind were consequently along the banks of rivers. When the banks happened to be high, as the site of old London within the walls, then the conditions of health as well as transit were attainable. When low, as in the marshes of Kent, Surrey, and Middlesex, then of necessity the conditions of health were difficult of attainment. Still, transit being the primary necessity of a city, the absence of facility other than by water caused an increasing population simply to radiate from a centre with little regard to the conditions of health. Now, inasmuch as man is by necessity a production of the soil and climate on which he is born and in which he dwells—modified by the quality of his food and clothing, and warmth and shelter—it follows that if London had followed the sites of the healthiest localities, *i.e.*, the high levels, and the low grounds had been preserved for gardens and orchards, the general population of London would have attained a higher condition of health, and, regarded from an economical point of view, would have been born and brought up at less cost, and would have resulted in a longer industrial life, as interest and sinking fund on the capital so expended. The low grounds left as garden and orchard would have been the natural recipient and deodoriser for the sewage of the high ground; improved health would have increased wealth generally, and prevented individual poverty, and, as a consequence, a highly moral population, the population of a healthy climate, would have existed throughout the metropolis, divested of the plague spots which the labours of philantropists have laid bare and done much to remove—for London, natural London, is probably second to no part of the world as a healthy residence. Had our earlier legislative bodies understood the conditions of health, it is not improbable that a standard building act would have prohibited the erection of dwellings on unwholesome sites calculated to lower the standard of health and life, and thus have enforced the means of rendering them artificially healthy, or of forcing the population along the higher grounds. Had this been done, improved means of locomotion would have become an imperative necessity, and the brains of an earlier period might have induced the development of rails for town transit, as well as for the conveyance of minerals in distant localities. The absence of cheap transit, together with lower rents, induced the spread of buildings over unwholesome flats below the river level; but it may be taken as a rule, that the low rent is a fallacy, and that the doctor absorbs more than the difference, saying nothing of the loss of time and diminished length of life. As time rolls on, and knowledge spreads, it will be more and more understood that not merely the poor but the wealthy classes also, suffer in degrees by the existence of malarian humanity, and the probability is, that the appropriation of low-lying lands, as at Battersea, for public gardens, will in time lead to the removal of acres of brick hovels run up by building speculation, on sites, and with materials, utterly unfitted for the dwellings of human beings.

A more beautiful site for a great city could not well be imagined than this of London, having regard to so large a population. The hills or high levels of Middlesex, on the one side, and the hills of Surrey on the other, are the true sites for North and South London—the dwellings of health. The river flats are the garden-grounds laid out by nature, with the broad river rolling between for transit and drainage; space for air—space for exercise and recreation in fine weather—and for intersecting roads communicating with north and south. With the constant increase of population, the Surrey hills will assuredly be covered with dwellings, with the site of the Crystal Palace as a nucleus, and the expansion of London, with the increasing light of knowledge, will take the direction of the high grounds and go out of the low river levels, if the means of transit be facilitated. It is therefore the interest of the owners of estates eligible for building purposes, thoroughly to understand the best modes of transit.

Leaving the courses of the rivers, the earliest roads were tracks for horses and other animals. When the loads grew too heavy for the horses, sledges were substituted, and the sledges were subsequently converted into carts by the application of a roller beneath them, similar to the crushing roller of the modern farm. The roller, from its great friction on the surface of the ground, then assumed the form of a pair of wheels fixed on a shaft, which revolved in bearings, like the rowlocks of a boat. Such are the existing wine carts of Spain, Portugal, and other countries; and, curiously enough, such are in principle the wheels and axles of our modern railway carriages. The Portuguese cars have inside bearings, and railway wheels, have sometimes inside and sometimes outside bearings.

Fig. 1.

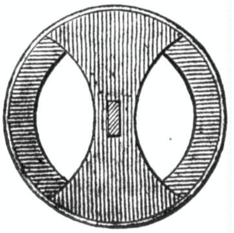
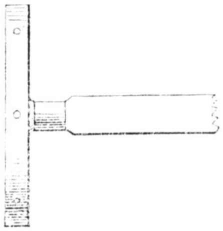
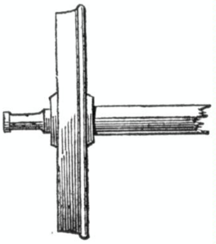


Fig. 2.



By reference to the diagrams, Figs. 1 and 2, it will be seen that the wheels of the Portuguese car, supposing them to be of equal diameters, are only calculated to run forward in a straight line. If they be of differing diameters, they represent a cone, and they will only run in a curved line; and any movement out of the direction they tend to, can only be produced with excessive friction, and a squeaking noise is the result, which is humourously ascribed to the orders of the custom-house officers, to guard against smuggling.

Fig. 3.



Referring to the railway wheel diagram, Fig. 3, it will be seen that the peripheries are conical in opposite directions, and that they rest upon the two rails with the guiding flanges between them. Therefore, on a straight line, the rolling movement will so adjust them as to keep the bearing on equal diameters. If the line of rails be a curve, the wheels will move to right or left till their bearing diameters correspond to the difference in length of the outer and inner curve of the rails, supposing that the play between the flanges and the rails be sufficient lateral to permit the movement.

But this is on the supposition of a single pair of wheels, with perfect freedom. If two or three pairs of wheels be attached to a single carriage, their free movement will be impeded. If the diameters of the wheels be all exactly alike, and the axles all parallel and rectangular to the traction, they may move on a straight line of rails without friction. If on a curved line, their movement will be one of considerable friction, unless the axles are made to radiate to the centre of the curve, and with free movement to regulate the coned diameters.

If the axles be arranged parallel to each other, but not at right angles to the line of traction, the free rolling movement will be converted into a sledging movement, and so also if the axles be not parallel with each other, save when on a curve corresponding to the angle formed by the axles.

All these evils are aggravated by screwing forcibly together a number of carriages to form a train, which becomes a kind of long sledge, moving with great friction, as may be verified by watching the polished glint on the surface of the rails after a train has passed over them, the burnish being produced by rubbing and not by rolling.

Trains of passenger carriages are thus screwed up together in order to prevent lateral movement, annoying to passengers. But trains of goods or coal waggons are left loose, connected by a chain. The first thing an engine-driver does when about to take out a train of coal waggons is to back them all one on the other. The first one starts the second, the second the third, and so on, the impetus gradually increasing and overpowering the inertia till the whole are close together. The engine then advancing in the opposite direction starts the first, second, third, and so on, till the whole train is in motion.

If watched from a bridge above, the train will be seen in sinuous movement, the wheels of each waggon moving laterally to accommodate themselves, not to the great curves, but to innumerable small curves, formed by the irregularities of the rails at joints and elsewhere, the wheels pressing at intervals on the inside or the outside of the rail breadth.

So long as two-wheeled carts were used upon rough roads, it was just possible to overcome their friction, but when the loads became heavy enough to require a waggon on four wheels, movement became impracticable, even though the front axle was made to turn at an angle with the hind one. This necessitated the revolution of each wheel on an axle-arm independently of the other wheels. The sledging movement was thus immediately convertible into a rolling movement, with greater or less friction according to the structure of the axle and wheel and the good or bad surface of the road.

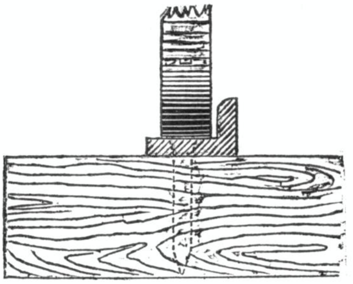
In proportion to the roughness of the surface it became desirable to increase the diameters of the wheels to span the hollows. But very large wheels have advantages and disadvantages also. If the speed be very great, the axle friction is reduced by diminishing the number of revolutions—a positive advantage. But a very large wheel becomes a disproportionately heavy wheel, and for steep ascents, for horse traction, frequently loses more than it gains, while for descents it helps to overrun the horses. It became, therefore, a much more desirable thing to improve the roads than to enlarge the wheels.

The earliest roads were the simple surface of the earth. When worn into ruts, a new and parallel track was taken, and then another and another. What are called wheel roads in the Pampas of La Plata and the steppes of Russia, are examples of this. But this kind of accommodation was only available on broad plains, with land of little or no value. On valuable land, or in mineral districts or rocky valleys, it was needful to repair the tracks when worn. Where stone existed, the obvious method was to break it into small pieces, and throw it into the ruts, as was the case in Derbyshire and elsewhere, and this no doubt was the earliest kind of macadam.

In the coal districts of the North, where land was valuable, it became the practice in opening a coal-pit to hire a "way leave," or right of way, or leave a way open which, if the pit worked out, could again be used for cultivation or grazing. If the ordinary ground was used to travel on, a horse could only draw about 17 cwt. of coals, and to amend this the earliest railways were devised, viz., a system of cross sleepers, placed two or three feet apart, and on these were trenailed down longitudinal wooden rails, squared to a section of six inches broad by five inches deep, the guage of way being four feet. On these wooden rails, which formed a substructure, were trenailed down other pieces of timber, which could be taken away and replaced when worn. On this kind of railway a horse could draw 42 cwt., or two-and-a-half times the load of the ordinary road. The introduction of these roads took place about the year 1600. It was, of course, necessary to level the ground beneath and around the timbers for the horses' feet, and this therefore constituted the first invention of railways, an invention forced on by the absolute necessity of a continuous stream of traffic which ordinary roads were unequal to.

The wear of the timber begot the practice of covering it in parts with plates of iron, in strakes like the tyre of a wheel. Subsequently cast-iron plates were used, of an angular form, stretching from sleeper to sleeper, an elevated rib rising from a flat plate fastened down to the sleepers, the ribs being either inside the wheels or outside. This kind of rail was called the tramway, either from the name of the engineer who first used it, Mr. Outram, or from the fact of its tramelling the wheels to their path. The objection to it was the facility of dirt lying on it, impeding the path of the wheels. This is shown by Fig. 4.

Fig. 4.



This ultimately gave rise to the invention of the edge-rail, *i.e.*, the rail projecting above the surface of the ground, and without a guiding flange, which was applied to the wheel instead. The forms of the rail were various. Fig. 5 shows a section of rail, with a broad flat base, spiked down upon sleepers, commonly used in the United States. Fig. 6 a bridge rail, usually screwed down upon sleepers. Fig. 7 a rail with a broad head but narrow base, to provide for which a cast-iron chair is used. Fig. 8 shows the double-headed rail, also used with a chair, and intended for reversal upside down when worn.

Fig 5.

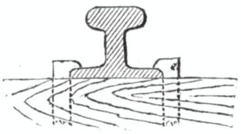


Fig. 6.

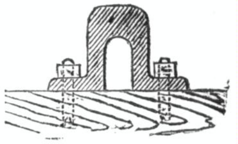


Fig. 8.

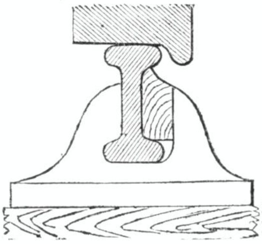
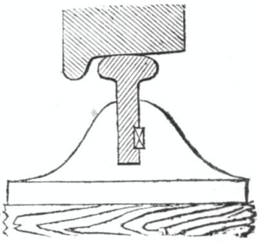


Fig. 7.



All these systems of rails, whether tramways or edge rails, project above the surface, and the wheels are guided by both rails, and cannot be guided by one rail only, or they would run off. This fact involves a very complicated arrangement of what are called switches and points and crossings, when it is required to move a train from one line of rails to another, a system which involves also great expense in repairs and considerable risk of getting off the line, in case of any irregularity at high speeds.

The fact of projection above the surface, and the speeds used, led to a general impression that railroads must be distinct roads from highways, and that it would be impossible to use the same road for both purposes. Yet even upon the railways the fact was practically demonstrated to be otherwise, for at what are called level crossings the spaces between and outside the rails are boarded over to the level, to allow ordinary vehicles to pass over them. It is true that this involves a greatly increased expense.

In years past before edge railways existed, I was familiar with many of the locomotists who advocated and practised the use of steam carriages on common roads, and who, considering the difficulties they had to contend with, practically accomplished great results. Mr. Walter Hancock was one of the most untiring, and I frequently pointed out to him that his chief difficulty was the want of solidity to sustain the load of his wheels, and that he must take either to stone curbs or iron rails before he could succeed. He could not accomplish this; for although the law allowed him to run his steam carriage on the road, it did not allow him to repair, and still less to improve the road. The law allowed the road trustees to dictate the width of tyres in proportion to load, or to charge accordingly, yet, notwithstanding, permitting dished wheels, with coned peripheries, to scoop out the road while rolling, without regard to damage, but giving no specific instructions as to the hardening of the road itself, so that the injudicious application of road metal could, at their will, prevent traffic altogether.

Still, my own conviction remained that iron tracks were the true solution of the problem. In proportion to the smoothness and hardness of the surface is the facility of draught and the saving in wear and tear of vehicles. A railway is better than a highway, in virtue of its hard and smooth surface, its self-guidance for the vehicles, and its better level. But if the vehicles running on a railway be greatly in excess of its strength, they may involve more resistance than an omnibus running on a hard modern road which does not yield under the wheels.

A rail should be—having regard to the load on it—so wide as to prevent lateral deflection, and so deep as to prevent vertical deflection in itself, and it should have so much surface bearing as to prevent it from sinking in the ballast.

But it is not necessary in all cases that the haulage on rails should be performed by steam, though in most cases that is the cheapest mode of traction. The steam railways in the United States have given rise to horse railways through cities and towns. They began in a peculiar manner.

The American railways, it is well known, were made to run to and through towns and cities, instead of to them only. The inhabitants were rarely anxious, as in England, to keep the rail away from them, but the contrary. It was deemed necessary to run round street corners. The first engine was ordered in England, and was built by Messrs. Robert Stephenson and Co., at Newcastle-on-Tyne, with the requirement of going round a sharp curve. It was, therefore, constructed as a two-wheel engine, with a swivelling truck on four low wheels in front. This kind of truck, used in the workshop to carry large castings, was known under the euphonious name of a "bogy." The engine was, therefore, shipped and invoiced as a bogy-engine. From that sprung up the whole race of American bogy-engines and carriages upon two bogies, or eight wheels, and Brother Jonathan claimed it as his invention ; but that is all—in his own quaint phraseology—"bogus."

When the first railways began to work, the town-authorities stipulated that the engines should be unhooked, and horses used to draw the trains through the streets; though subsequently this was compounded for by working the engine slowly, under a large maple slab, on which was painted :—"Look out for the engine when the bell rings."

Once familiarised with railway carriages drawn by horses, the observant American mind was not slow to perceive that the arrangement was very superior to omnibuses for town transit. Street after street in New York and other cities was laid down with rails, and on streets of great traffic many lines of rails were laid down side by side. Broadway is one of the few streets without them, and even that has been the subject of a lawsuit between *pro* and *con* railers.

A Frenchman imported the plan to Paris, and it is probable that it will become an universal Continental practice.

But it has not been done in England, not done in London, in Manchester, or other great towns, where the amount of traffic seems imperatively to call for the introduction of the system. Why has it not been done?

The answer is plain. The whole thing is so simple and easy, and the outlay needed so small, that there is no scope for either lawyers or engineers. There are neither bridges nor works to execute, nor, if managed rightly, any Act of Parliament to obtain, and no large number of persons to be interested.

In any change to be made, people of considerable energy are required, with good capacity for business. These people are not numerous, and justly require high payment. It is a very common thing to quarrel with engineers, and lawyers, and contractors, and vituperate them for making large fortunes out of railway shareholders, but we may be quite sure that, but for the large prizes held out as inducements to these men, we should have had no railways. Individual energies are the sources of national gain.

My own pursuits having been connected with transit of all kinds, both before the advent of railways and after, and having, moreover, been many years a traveller and sojourner in various other lands, observation would have been forced upon me, even had not taste and perception led me to speculate upon, and essay to improve, the facilities of transit, whether by land or water.

Revisiting England in 1826, where the steam-locomotists on highways were earnestly at work, the subject attracted much of my attention, and I very soon came to the conclusion that steam could not work to advantage upon gravel or macadam, and that the first thing to do was to lay down stone slabs or iron rails. But there was a prevalent crotchet about adhesion, and an unfortunate insufficiency of purse amongst the projectors, and an utter unpopularity amongst all those connected with horseflesh. The legislature liberated the locomotists from tolls, but road trustees and surveyors were free to bury the wheels to their axles in loose road metal, and ostlers at public-houses demurred to supplying pails of water to other than their own horses. The late Mr. Walter Hancock, in spite of all obstacles, was finally successful in running a steam-carriage as an omnibus from Paddington to the Bank and back during a period of four months, and then the struggle ceased. To have made it successful, there was needed, not one, but twenty steam-carriages at least, with station houses, water cranes, coke depots, and—rails. And all this needed a company and capital, which were never got together, as the scheme did not acquire popularity.

I once asked an omnibus proprietor, whether he would like the monopoly of the road between Charing-cross and the Bank, starting every half-hour. "Lord bless you, sir," was the reply, "I should never get a customer; they would all walk on."

And this is one reason of the difficulty in introducing improvements; the single public carriage is lost, however much superior it may be, and it is too much to expect of human nature that the proprietors of existing vehicles should deteriorate their own capital by helping forward improvements. Any improvement in public transit must be the work of a company or of large capitalists, in order to make any way against opposition.

Rails on common roads being a favourite subject, I constantly advocated them in print and words. About the year 1843 I wrote an article in the "*Westminster Review*," in which I advocated laying down rails in streets, flush with the surface. In 1845, I advocated the same general system. In 1849, I published a pamphlet, entitled, "The Iron Ways," which was reviewed in the "*Times*" and "*Spectator*" and the railway periodicals. In January, 1850, I published a little work, entitled "Road Progress, the Amalgamation of Railways and Highways for Agricultural Improvement and Steam Farming;" treating of highways, railways, steam-carriages, turnpike roads, railway wheels and farm railways; and in Dec., 1850, I read a paper, advocating the system, before the Society of Arts, in which I stated :—

"It would be easy to convert the turnpike roads into a system of practicable railways, by inserting rails level with the surface, to travel on at stage-coach speed by steam. This arrangement would place the whole of the agricultural districts of England in a rapidly improving condition, the farms at one end of the line and the markets at the other. The ordinary traffic would not be interfered with by this plan of rails, as vehicles could cross and recross them."

In 1851, an attempt was made by Mr. Thomas Wright, to get up a company to make street railways, but without success.

Even supposing the street railway, *i.e.*, the permanent way, to cost as much as the steam permanent way, *i.e.*, about £2000, per mile single way, still it would be a source of great economy to make it. A notion prevails that as on common roads the vehicles are comparatively light, very light rails will suffice, but this is not the fact. The rails on common roads would be subjected to side blows and diagonal blows from heavy coal waggons and other vehicles, and therefore they need be heavy and tough. Wrought-iron only can be used, for cast iron always crumbles away at the joints, even when made strong enough not to break by blows. If wrought-iron be used, it may be used with or without timber sleepers. In most cases, it will be an advantage to use no timber whatever, on account of its rapid destruction, but if used it should be merely as a packing below the rails, and not as a part of the structure.

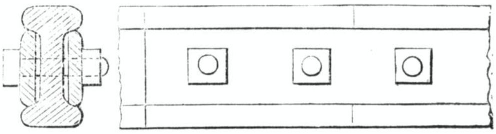
The structural detail is a matter of great importance. The requisite conditions are:—First. Strength to resist violence. Secondly. Simplicity of structure and fewness of parts. Thirdly. Sufficiency of depth and width to give vertical and lateral resistance, and continuous strength at the joints. Fourthly. Facility in laying down, maintaining, and replacing. Fifthly. Non-interference with access to drains and sewers, and water-pipes below. Lastly. Economy in cost.

I have had many plans of structure with rails made on purpose, but it has for some time past occurred to me that the existing rails of railways worn out by the locomotive are perfectly well adapted to street use. They therefore afford us the means of great strength of iron at low cost.

There are two considerations, either to adapt the street rails to the wheels of the ordinary omnibuses and cabs, or to adapt them to a special form of wheel tyre.

For ordinary wheels, my plan is as follows:—The common double T rail used on the narrow guage railways is as Fig. 9, 5 inches in height, and 2½ inches in width. It is connected together at the joints by a patented invention of mine, called the fished joint, iron fishes fitting in the lateral channels, bolted by four cross bolts.

Fig. 9.



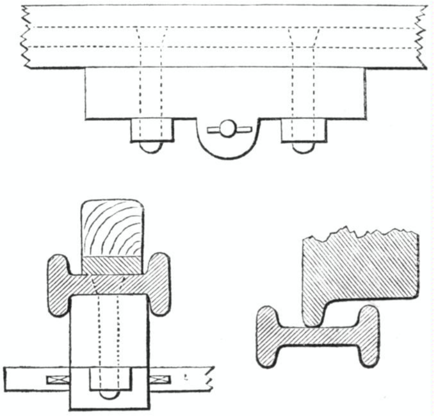
In practice the wheels of the locomotives with six tons dead weight on them, abrade the upper surface, while the lower surface is damaged in the chairs. But the side channels remain intact. I therefore take the rails and lay them down flat, bolting them at the joints to a block of cast iron through the fish bolt holes, the same block being provided with a horizontal hole, in which is received a tie or guage bar, connecting the two opposite rails together, as shown in Fig. 10.

These rails, 15 feet long, are laid in the ground flat with the surface, and the tie-bar, buried below, keys them down. As the greatest load that can come upon them is one ton per wheel, instead of six tons per wheel in the vertical position, the strength will be more than ample.

There is another consideration, their bearing surface on the ground to prevent the rails from crushing in. As usually laid on railways, the bearing surface is formed by the sleepers. In a first-class cross sleeper road the sleepers are laid three feet apart; the practical bearing surface of each sleeper is about six feet, which is about two feet per foot run of the two rails. The two rails laid flatwise give a bearing surface of 10 inches per foot run. If, therefore, two feet be equivalent to 12 tons on two wheels, 10 inches will be more than ample for two tons on two wheels. In the case of the locomotive, the bearing is two inches per ton; in the case of the street traffic it is five inches per ton; and the lateral strength of each rail is increased from 2¼ inches to five inches. They would be competent to engines with not more than two tons on each wheel.

In the channels of these rails the ordinary omnibus wheels can run, and, supposing the guage the same, ordinary railway waggons could run equally well, the wheels running on their flanges instead of their tracks.

Fig. 10.



In the tramway, Fig 4, and the edge railway, Fig 5, it will be seen that both rails are essential to keep the waggon in track. But it is worthy of remark that in these channel rails one rail only will serve for guidance, and the opposite rail may be a simple plane surface, as in Fig 14. Considerable lateral friction may be avoided by this arrangement, as it will permit of slight inaccuracies of guage in the omnibus wheels.

There is one disadvantage in the channel rail,—dirt may get into it, which will not rest on the edge rail. This may be obviated in two ways; a spring scraper may be attached to the vehicle, and smart lads from the red or blue Shoe Brigade might be selected and provided with a crooked stick each, to patrol the line.

It is obvious that ordinary omnibuses running on these rails would be in no difficulty; if requiring to turn off and run on ordinary roads, they can easily be turned out of the rail channels, without any necessity for points and crossings, or any of the expensive paraphernalia needed on railways by reason of the great weights.

The junctions for ramifications are easily made by connecting two lines side by side with a double casting and cutting away the rib between them.

On ordinary roads it will be found sufficient to use a macadam surface between and at the sides of the rails. In streets it would be desirable to pave next the rails, if not all over the surface, and my plan of paving would be different from the ordinary road.

For the passage of wheels, it is desirable to have the surface as smooth as possible, but for foot hold for horses' feet it is desirable to have a certain amount of roughness. The earliest stone-paving was with boulders, gradually replaced by cut granite, in pieces of greater horizontal width than vertical depth. The present practice is to use these deep stones laid in parallel lines, and to connect them by hot lime grouting. When new the surface is rough and suited to the horses' feet, and the interlocking of the groutings makes the stones a continuous body. But the surface wears smooth, the grouting cracks, and the stones sink in detail, being vertical and each depending only on its own base when the bond breaks.

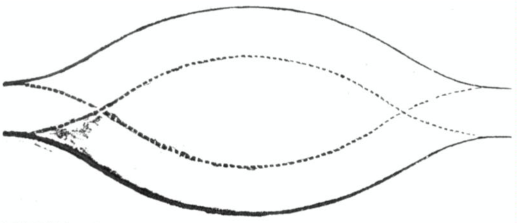
I propose to lay the stones at an angle of about 45° one upon another. Thus in the case of vertical blows every stone is supported by the others, and there is less tendency to crack the grouting. Moreover, one of the upper edges of the stone is an acute angle, which instantly breaks away as it is worn thin, and a surface adapted to the horses' feet is thus maintained to the last.

In the railway wheels which are fast on the axles as shown at Figs. 3, 7, and 8, the cone form of the peripheries, as before described, is supposed to compensate for curves and irregularities. If it does this, it is clear it ought to run as it were on knife-edges. If the profile of the wheel corresponds to the profile of the rail it is clear that a large amount of friction must ensue analogous to that produced by broad waggon wheels which are dished and curved on their peripheries. The vertical wheel is in all cases best, and with a cylindrical tread, but it is essential also in such case that every wheel should run loose on its axle.

It is essential, also, that brakes should be used for the purpose of stoppage or for retardation on inclines, and very simple mechanical means may be rendered available to facilitate the transit up inclines.

Supposing single lines to be used in the first instance, it will be desirable at intervals to make turns out, as shown by Fig. 11.

Fig. 11.



For the purpose of returning, the rail may be of a horse-shoe form, so that the carriage, guided by the wheels on one side, will turn round in a circle. The diagram, fig. 12, shows this arrangement with one rail and a flat surface. Fig. 13 shows a turn-out.

Fig. 12.

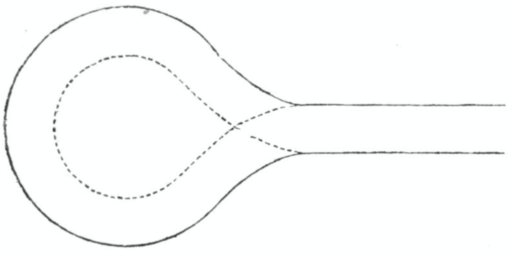
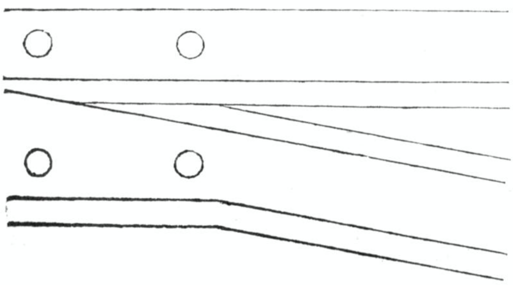


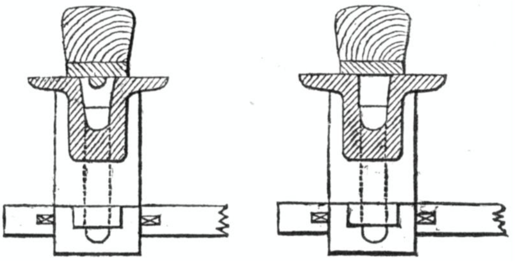
Fig. 13.



This system offers peculiar advantages to railway companies for communicating with towns and villages at a cheap rate. They have abundance of iron rails, and the cost beyond the rails scarcely exceeds two to three hundred pounds per mile. There are many localities where railway communication is very desirable, but the cost of works, bridges, permanent way, stations, and Act of Parliament, is an absolute prohibition. In most cases there is a highway or turnpike, or occupation road, skirting the rail and communicating with the town. With the old rails laid on the road on the plan just shown no stations are required, for the rails can carry vehicles to the doors of the existing inns along the existing streets, and if horses be not sufficient, small engines, with wheels of small diameter, and not more than two tons on each wheel, can be used on them, a class of engine adapted to the makers of the portable farm-engines.

So far as regards the conversion of the ordinary double **T** rail to streets and roads; but there is another rail also well adapted to the same purpose, and possessing greater lateral and vertical strength for this purpose, — the bridge rail, Fig 6. The form of the bridge rail is a hollow, and it is applied as shown at fig. 6, upon railways. For street and road purposes it is reversed, with the groove above, resting on the bottom and the side flanges, as shown at fig. 14. At the joints, the connection is made by a channel-formed iron casting, bearing beneath the flanges and bolted through the crown of the rail. A tie-bar passing horizontally through the casting connects the two opposite rails together.

Fig. 14.



The wheels to run on this kind of rail will require flanges in the centre of the breadth of the tyre, as shown. But it is not necessary to have flanges except on one side of the carriage; the opposite side may be plain tyres. A spring scraper will keep the grooves clean, or a boy can be employed. All the other arrangements will be the same as before described with the double **T** rail.

These rails are six inches wide each, and about 3½ deep, therefore the bearing surface of 12 inches should be equivalent to six tons, or three tons per wheel.

This system of rails through the streets affords a facility for carrying on the traffic, when access is required to the water-pipes, drains, or sewers, which is not the case with the ordinary paving, as most people know to their very great vexation. With the rails, if there be need to excavate below them, the operation would be to open up horizontal trenches transversely at three to four feet apart in which to lay sleepers for the rails to rest on, much in the same mode that is used to suspend the water-pipes. On the sleepers are laid planks for the horses, and thus the excavation can go on below without any interruption.

Ordinary wheels could not run on these bridge rails, but light engines could, in suburban districts, or on railway branches.

It is obvious that convenient carriages, similar in construction to railway carriages, could be used on these lines, but without the necessity for their great dead weight. Frames and wheels might all be of the lightest construction, as there is no longitudinal concussion to apprehend.

This paper relates to the streets and suburbs of London n particular, but the result would be extension to communicate between railways and turnpike roads. I will, therefore, read an extract from "Road Progress," bearing on the subject.

" The original cities and settlements of mankind are found along the banks of rivers, as being the best adapted to their wants during the rude state of the arts. There is usually found the best meadow land; there is found water for transit purposes, and for the purpose of turning mills, for grinding and fulling, and for tan-pits and dye-houses. The valley of the river also forms the level for the highway. But to set against all these conveniences, the sites are usually unhealthy, and as population increases, the stream becomes a filthy open sewer.

" With the railroad—the artificial level—all this may be changed. With the water main, the gas main, and the sewer laid along that level, houses and farms become practicable. Irrigation and manure are available through the whole extent. With the farms on the railway line, and the markets at the terminal and other stations, the reduction of expense in transit would be carried to its maximum. So long as a few miles of horse transit to a railway, and a few miles from the railway, shall be needful, the railway will be comparatively of little use; the expense of double trains, and loading and unloading, will destroy the profit.

" It is this consideration that renders it imperative to devise some means whereby farms in general may be connected with railways, and this opens up the general question of turnpike roads, highways, and parish roads.

" According to the Parliamentary Report for the year 1847, there exist 22,324 miles of turnpike roads in England and Wales, about 20,000 being in England alone.

" The total income from these English roads was £1,242,393 6s. 8d., or about £62 per mile.

" The total expenditure on these English roads was £1,256,056 4s. 7d., exceeding the income by £13,662 17s. 11d.

" The mortgage debts £6,262,998 17s. 2d., or about £311 per mile.

" The unpaid interest £1,467,238 17s. 11d.

" The total debts £7,873,252 6s. 5d., or about £394 per mile.

" MAINTENANCE OF WAY.

" Manual labour . . .	£299,499
" Teams and carriages . .	126,751
" Materials, land, and drainage .	192,255
" Tradesmen's bills . . .	46,085
" Total .	£664,590

or about £33 per mile.

" What the highways and parish roads amount to in mileage, no parliamentary data are yet given, but they must far exceed the turnpikes in amount.

* * * *

" The first objection that will be made to this proposition is, the rendering the roads impracticable for other purposes.

" In answer to this, the proposition is to insert the rails in longitudinal timbers, the whole being bedded to the level of the road, so that they will not prevent the occasional transit over them of carts and wagons, any more than the existing level crossings of railways or tramways. Supposing the roads to be of sufficient width, the best position of the rails would be the centre; and if we suppose the present railways to be bordered with highways on each side—turning out when required, we should have a similar result. Even at the towns, and through them, if the streets were wide enough, it would be better not to go round, as is the case in the American towns at present; so that we have examples for those who will not believe till they see, and will not put in practice anything till they do believe—the class of people who would be Chinese, were there no " outside barbarians" to stir them with new matter.

" But in old towns, where the streets are narrow, crooked, and hilly, the road must go round by the back by a turn-out. The inevitable result of this must be, that the back street would become the main street. Thus, in most roads the rail would be in the middle, but in many it would occupy one side. The minor difficulties of fixing water-tanks so as to supply engines in the middle of the road, would be very trifling. The existing sign-posts indicate the means sufficiently.

" Difficulties may occur occasionally in crossings being objectionable on the level, but in such cases it is not difficult to span the way with bridges. It must be borne in mind that the subject is always treated with reference to light carriages and engines; and when it is considered that for many years an incline of one in thirty-seven, three miles in length, has been worked by the ordinary heavy trains, there can be no difficulty in imagining that the ordinary highway gradient—the Telford gradient of one in thirty—can easily be worked by the light trains, so as to keep the approaches to bridges short.

* * * *

" Another objection will be that rails laid on highways will be subject to various damages from accidents. Heavy waggons may damage the rails, by wilful violence, and the way may be obstructed purposely, or by stones rolling into the grooves left for the flanges.

" In answer to this, we may assume at the outset, that such rails will not be laid down without two preliminaries, the desire of the road creditors and managers, and also those whose property it passes through, and an Act of Parliament to sanction it. There cannot be much doubt that the road creditors will be willing; for they want tolls—interest for their money. And the same class of persons who now break stones on the roads would have to keep them clean—viz., the paupers. Of accidents there would be little risk from getting off the rails, because the railway would be light, and the rail joints would be continuous, with a hard road on the same level. With regard to heavy waggons being used wantonly to damage the rails, remedies would be provided for that; but the fact would be, that no heavy waggons would be used, when once a railway existed—they would not pay.

* * * *

" It is quite certain that from the time the first road shall be shown to be practicable, the whole of the main roads in the neighbourhood of London will be laid down with rails. The saving in " maintenance of way," would be economy—for the average £33 per mile of the turnpike roads must be very largely increased in the environs of the metropolis by the large traffic.

* * * *

" Of the value of an alliance between highways or turnpike-roads and railways some idea may be formed by calculating the difference between two thousand pounds per mile laid out on the highway to connect Nine Elms with London Bridge station, and the sum actually expended to get from Nine Elms to the Waterloo-road, half way to London Bridge, only substituting one inconvenient terminus for another.

" It is the interest of so many persons, householders, landholders, farmers, and others, to bring about this change, that it cannot be put off longer than till the practical demonstration shall have taken place in a sample line of road. Most new things, till done, are regarded as Utopian and impracticable.

" Had the perception of the practical importance of this proposition dawned on the minds of local authorities, the expense of the costly branch lines that have diminished dividends, might have been avoided, and lines of way skirting the dwellings of the population might have been attained at a very low cost. Whenever a highway-bridge, or turnpike-road, or occupation-bridge, crosses a line of railway, there is the point for a junction, which for light trains might generally be accomplished with very little expense in forming the gradient.

" Now supposing such junctions formed, and that rails be laid down on the roads leading to the town, direct railway waggon communication is obtained. From these towns the parish roads diverge, and rails laid on them might be carried direct into the farmyard. Here, then, we have the produce at one end of the line, and the metropolis or other town at the other end. Under such circumstances, the farmer's carts and waggons would be put out of use, and the light locomotive would be standing in his yard, having brought him a freight of coals, or stone, or earth, or manure, in exchange for his wheat or vegetables.

" From this farmyard, lines of moveable rails would be found well adapted to take the waggon and manure by horse-trucks to the centre of each field; or a farm locomotive might be established thereon—a preparation not for ploughing, but for doing the same kind of work better by harrowing; or it might be used to pump water up, to drain away, or to pour over the fields in irrigation; or to inject gaseous manure, or heat, or both combined, beneath the surface of the land for the sake of improved produce. With a small portable saw-bench and morticing machine ready to connect to the engine, the farmer might, with the rude skill of his own farm-labourers, construct, from time to time, all the wood-work he might require, as is the common practice among farmers in the United States.

" It is difficult to estimate the importance of carrying *coals* by rail direct on to farms. From that time the farm will take rank with the factory in its labour-saving processes, and the production of food will be so cheapened as to put to rest for ever the fear of foreign competition. Without cheap coal, farm operations can but be very imperfect."

The very large district lying on the borders of the Great Northern Railway, on the Lincolnshire flats studded with towns and villages, is admirably adapted for this system, and so also are the levels bordering the Eastern Counties system of lines, in Cambridgeshire and Essex.

Having now gone through the mechanical question, and I trust demonstrated the certainty and facility of the operation, I come to the question of London and its suburbs, the direction of the lines, their length and cost.

There are several centres from which streets and roads radiate. The most prominent is Charing-cross. We will take the various points it is desirable to reach from thence, and the distances.

CHARING-CROSS CENTRE.	Distance in Miles.
Spring-garden, St. James's-mall, Buckingham-gate, Victoria-road, Commercial-road, and Battersea-park	2
Buckingham-gate to South Kensington	1¾
Charing-cross, by Piccadilly, to South Kensington	2¼
Battersea-park to Sloane-street, Knightsbridge	1½
Round Battersea-park	2
Sloane-street, Kensington, to Chiswick	4
Battersea-park to South Kensington	2
Hyde-park-corner to Sloane-street	½
Charing-cross to Regent-street, Oxford-street	1¼
Charing-cross to Gracechurch-street	2¼
Charing-cross, Parliament-street, Victoria-street, and Vauxhall-road	1¼
TOTTENHAM-COURT-ROAD AND OXFORD-STREET CENTRE.	
Tottenham-court-road to Tyburn	1¼
Tottenham-court-road to Kentish-town-hill	2½
Camden-town to Kentish-town-hill	3¾
Tyburn Turnpike to Hampstead Railway	3
Tottenham-court-road to Gracechurch-street	2
ST. GEORGE'S-ROAD, OBELISK CENTRE.	
London-bridge, Blackfriars, and Waterloo	3
Elephant and Castle, two routes	½
Dover-road, Old-street-road to New-cross	2½
ELEPHANT AND CASTLE CENTRE.	
To Dulwich and Crystal Palace	6¾
To Brixton	3½
To Clapham-common and Balham-hill	4
GRACECHURCH-STREET CENTRE.	
To Stamford-hill	4
To Bow, Stratford and Eastern Counties Railway	4½
Shoreditch Church, Victoria-road and Clapton	4
Paddington to the Bank, by the City-road	5
City-road and Holloway-road	3
Total	69

Railway companies, with their own workmen and their own old rails, would make their lines at from £750 to £800 per single mile.

Supposing the lines made by individuals, or small companies buying old rails, the cost might be about £1,000 per single mile. The total double mileage would therefore be, say 140, and the capital £140,000. Taking depreciation and maintenance at 20 per cent. per annum, the annual outlay would be £20,000 a year, being the large sum of upwards of £200 per mile, and far beyond what it would really amount to in practice.

The existing omnibuses are about 1,000 in number. We may assume that they pay, or they could not be maintained. The result of the rails would be to diminish the traction by at least one-half. To keep these omnibuses going at present requires 8,000 horses. We may assume the interest and maintenance to amount to at least 15s. per week each. If one-half were saved, that would amount to £3,000 per week, or £150,000 per annum. This leaves a large margin for—shall we call it propitiation—dealing with parishes, and diminishing their paving rates in order to avoid Acts of Parliament.

But a new class of omnibuses would arise, of more convenient structure, and the result would be to increase the number of passengers, while diminishing the cost of transit. It would not be a large undertaking for a company to lay down the whole of the rails for the main thoroughfares and suburbs of London, but it might also be done by separate companies.

We will take another contingency. It might happen that old rails would rise in price by the demand for them, instead of being sold for old iron. The lines might cost, say £1,200 per mile.

From the Strand, over Waterloo-bridge, by the "Elephant and Castle," to the Crystal Palace, measures about eight miles. This would be £9,600. Say £2,000 per annum depreciation and maintenance. The time of transit would be about one hour. The vehicles could be as comfortable as railway carriages, and much lighter, lighter in fact than ordinary omnibuses, in proportion. They could carry 56 passengers each, and they might follow each other every five minutes, or less. Twelve vehicles would thus convey 672 passengers in less than two hours. Twenty-four vehicles, at shorter intervals, 1,344 passengers in two hours, and would land them at the level, saving the "getting up stairs." Of course, extra haulage would be required on the steep inclines, but extra horses or small engines might be used for that. The vehicles could be all on return in two hours, and be taking several batches. In short, with 24 vehicles, 56 passengers at one hour from the time of starting, could be delivered every 2½ minutes, or 1,344 per hour. Six hours running would be equivalent to upwards of 8,000 passengers delivered, and six hours more for the return, making 16,000. At sixpence per head, this would be £400 a day. Take the vehicles only half full, it would leave £200 per day, or £62,600 a-year revenue, without counting Sundays. If one-fourth full, £31,300. The account would stand thus:—

CAPITAL.

Railway	£9,600
Say 30 vehicles	9,000
	£18,600

WORKING EXPENSES PER ANNUM.		REVENUE IF ONE-FOURTH FULL VEHICLES
Maintenance of way	£2,000	£31,300
Do. of 24 vehicles, 28 miles a day each	2,000	
Horse-hire, 200	10,400	
24 drivers, 24 conductors	5,000	
Tolls, say	3,000	
		22,400
		£8,900

The extreme capacity for transit would be, taking going and returning, at 6d. per head each, £125,000. Now when we consider we have the Crystal Palace, the dwellings along the line, and the dwellings yet to be erected on eligible building land on the Surrey hills, and possibly many fairy gardens yet to be made for public resort, we may certainly calculate one-fourth full, and if the fare were reduced to 4d., the increase would probably be raised to one-half.

And this is but a small portion of what has yet to be accomplished, through the length and breadth of the land, in other towns, and cities, and highways, and byeways, and parish and occupation roads, and over 22,000 miles of turnpikes.

If I have satisfactorily demonstrated that there is yet a large unworked amount of property in the country capable of being brought to use by energy, with a comparatively small outlay of capital, I trust that my words will not fall on dull ears, but that the thought of the brain will grow to be the work of the hand and purse, and that the advent of a new and smaller class of railways will add to the prosperity of those magnificent works that have pierced the whole country as with vital arteries, giving it the boundless wealth that has fought our battles in the great struggle for freedom and human progress.

DISCUSSION.

Mr. Curtis gave a history of a primitive description of tramway which he had adopted in the West Indies, for removing large timber from the forests, and which could be constructed at about 500 dollars per mile. In the carriage of timber by this means from the forests in which it was felled, it was found that three or four bullocks could do the work of thirty or forty when the loads were carried over the natural surface of the ground. He referred to the system of horse tramway which had been so successfully adopted from Paris to St. Cloud, and also in the wider thoroughfares in several cities in the United States. He apprehended that, as a condition of success, it was indispensable that the wheels of the vehicles should be so constructed as to be able, at the will of the driver, to leave the tramway at any desired point: they should also be of a form not injurious to the ordinary highway. Mr. Curtis proceeded to explain a patent invention of his,* of a composite arrangement of the wheels adapted for travelling on the tramway, and also upon the ordinary highway.

Mr. Shanks said,—Having often seen the horse railways in the American cities, and travelled by them, he was of opinion that they possessed great advantages over all other street locomotion in point of speed, cheapness, and comfort. In the American cities, which were all built in "blocks" or parallelograms, the chief bustling streets were never used for the horse railways, but the first parallel street was employed, so that the centres of commerce were easily reached by a short walk from the termini. He found also that these railways extended in every direction towards the country where the new streets were formed; in fact, they generally were laid down in advance of the building, so that even the first bricks used were generally carried on these rails. He (Mr. Shanks) was of opinion that they might be advantageously laid down in London in the localities mentioned by Mr. Adams, approaching only to the centres of commerce.

Mr. Hobbs believed the object of this paper to be the improvement of the mode of public conveyance in London, and he thought that anyone who was instrumental in bringing that about would be entitled to very great credit at the hands of the citizens. He did not believe there was a city in England that was so badly off in respect of public conveyances as London. The cabs were the worst and dirtiest that could be found anywhere, and the omnibuses were lumbering, ill-constructed vehicles—bad to get into, inconvenient when in, and as bad to get out of. Looking, however, at all the peculiar circumstances of London, he did not think that the improvement could be effected by horse tramways, especially in the streets of the City, where the traffic most needed relief. He mentioned the extent to which the system of horse tramways had been carried out in the United States—in New York, Boston, Philadelphia, &c.—up to the period of his leaving the States. He particularised the tramway which had been established in New York, extending from the City-hall to the Bowery, Broom-street, &c., thence to the avenues for a distance of about eight miles into the environs. In these cases the streets varied from 115 to 75 and 80 feet in width, and no inconvenience to the ordinary traffic was occasioned. In Baltimore they had tramways leading from the principal streets of the city to the north, south, and west stations of the railways, and these had been found a great public accommodation. In Philadelphia a similar system had been carried out, and also in New Jersey, although in the latter city the introduction of the system was in the first instance opposed by the inhabitants. Notwithstanding the success which had attended the system in the cities to which he alluded, owing to the favourable local circumstances, he had great doubts whether it could be successfully adopted in a city like London, where the conditions were so widely different, both as to the amount and the character of the traffic, as well as the width of the streets. He thought more could be gained by improving the present class of public vehicles than could be expected from the introduction of any other system of transit.

Mr. Marrable remarked that in New York the streets were of great width—a condition he saw no prospect of arriving at in London within the next three centuries, at least. There were several practical points in the paper to which he would call the attention of Mr. Adams. He would ask, whether he had considered the effect of his proposed system on the frequent disturbances of the streets for re-laying gas and water pipes? Again, how did Mr. Adams provide for the stopping of the carriages to take up and set down passengers, and how were foot passengers to get out of the way of a succession of carriages running at from ten to twelve miles an hour. At present there was much danger from the vehicles in crossing the streets, and this would be increased in proportion to the increase in the speed of travelling. The difficulty of turning out of the track at any point desired had already been adverted to, in addition to which there was the question of the gradients, as they could not always have the streets upon a level. He thought these were serious objections to the plan, and at present he did not see how they were to be got over.

Mr. Francis Bennoch agreed with Mr. Hobbs, that any one who could introduce a plan by which the traffic of London could be more conveniently conducted, would deserve not only the gold medal of this Society, but also the thanks of the community at large. It seemed to him that the paper of Mr. Adams did not touch the question they had to consider, viz: by what means they could get the enormous traffic of London from the centre to the circumference, with the least possible difficulty? Mr. Adam's plan did not extend to the centre, and only approached it at Gracechurch-street. He (Mr. Bennoch) would endeavour to show that the difficulties were such as utterly to prevent the realization of Mr. Adams's plan. They had been told of plans for conveying logs of timber through a forest of trees, with the materials for the tram-way at hand; but now they had to cut through a forest of people, a wilderness of bricks, and they could not lay down either houses or people to form the roadway. Again, he thought that to draw a comparison between London and New York, or other cities in the United States, was beside the question. The streets were of magnificent width, and the traffic of a thousand years had been anticipated. But here they had narrow streets and winding sinuous ways, with an amount of traffic almost incalculable. He had devoted more attention to the statistics of London traffic than, perhaps, any other individual not officially interested in the matter. He would point out some of the difficulties in connection with the traffic of the metropolis. It was not a question of the peculiar construction of the omnibuses or cabs, or how notice of their special routes could best be given to travellers. The question they had to deal with was how they could best deal with the general traffic of the streets of London. Mr. Adams's plan only carried them to Gracechurch-street as the nearest point for the City, and he had shown how they might go from thence to Clapham; he had also mentioned other centres, but all these were outside the precincts of the city. How were they to get from that great centre of traffic to the outside and remote points of divergence? He held that the only way of getting from that centre, east and west, was by a railway in connection with the embankment of the Thames. He did not see any other plan. At all events, in his judgment, it was impossible to pass along the crowded streets of London on a tramway. He had had occasion, during the last two or three years, to take an account of the traffic of London at several different points, and it would astonish the meeting when he told them its amount. The largest traffic was across London-bridge; there was nearly one-third more traffic there than in other thoroughfares of London. Second in amount of traffic came Cheapside, which, branching off to Newgate-street and Ludgate-hill, became divided. The next largest traffic was by Holborn-hill and Fleet-street. The fourth in amount was Blackfriars-bridge, so that the traffic over the water, north and south, in the main arteries was as great as that east and west. They might do what they liked, they could not accommodate the existing traffic in combination with that now suggested. If they had the tramways running opposite the doors of warehouses and shops, how was the shopkeeper or warehouseman to get his goods unloaded from the waggon to his warehouse or shop? Trains of carriages would thus become a nuisance—causing perpetual contests, excitement, and stoppages. He held in his hand a statement of the number of vehicles that passed over London-bridge from 9 in the forenoon till 6 in the evening, in 1850, 1853, and 1856.* The largest traffic in that quarter was from 11 to 12 in the forenoon, and from 4 to 5 in the afternoon. In 1850 the traffic in vehicles only over London-bridge, in the 9 hours from 9 to 6, was 10,769; the traffic for the same period of a day in 1853, was 11,498; whilst last year the traffic for the same period of a-day, amounted to no less than 13,119 vehicles, or an average of 1,459 every hour, and these vehicles were so locked and jammed together, that but for the regulations now imposed, London-bridge would be all but impassable. He had personally tested the fact only yesterday, and found that 50 vehicles passed over there in one minute. By what possible means, then, were they to accommodate those passengers who wished to come to and depart from the great city centres of traffic. They had no difficulty as regarded the outskirts—Paddington and such places, where the moving population was small, carriages few, and the thoroughfares wide. The difficulty was here to get to the Bank and back again with facility; and if Mr. Adams could introduce a system to accomplish that end, he would confer a great benefit upon society. At present they had no one fact from the author of the paper as to the traffic of the City and the necessity for its accommodation. Take Cheapside, for instance, and suppose two tramways—one running west and the other east, there would be no room left for the ordinary public traffic. What would become of such traffic as that conducted by Pickford, Chaplin and Horne, &c., which description of traffic—the great commercial traffic of London, was, after all, the great point to be attended to. This was of far more importance to this great commercial city than the transit of individuals who could walk where and how they pleased. If they could not accommodate that traffic, as it now existed, it seemed to him absurd to think of laying down a railway for the accommodation of passengers to and from the City. It was evident that within that magic circle, with the Elephant and Castle, Charing Cross, the Angel, Islington, and Whitechapel Church, they could not enter with this tramway plan, for neither the Strand, Holborn, Goswell-street, Blackman-street, Aldgate, Cheapside, or Ludgate-hill had width enough for the purpose. Outside that circle he saw no great impediment in the way of establishing a system of tramways convenient for those who resided in the environs; and the conveniences of such a system in provincial towns and cities could hardly be called in question. It seemed to him that as regarded London, where tramways were most needed, their introduction was impossible, and where it was possible, they were little if at all required. They might be useful auxiliaries to suburban railways, to places of popular public resort, but not as relieving the traffic that had become too gigantic for the narrow streets of London. In no other city of the world was the population so dense or the thoroughfares so crowded as in London, and no just comparison could be therefore instituted between this and any other city. Even in Paris the illustration of the tramway to St. Cloud could not hold good. It was only suburban traffic. They might carry the system with perfect ease along Rotten-row, so as to interfere with neither the carriage nor pedestrian traffic; and he saw no obstacle to prevent its adoption by the New road, round the outskirts of London; but to give convenience to the great masses of the inhabitants, he held it to be impossible, except as he had before stated, in connection with some grand scheme for the embankment of the Thames. By that means they might have a system of perpetual tramways and steam boats, and thus permanently relieve the overcrowded streets of the City.

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* Letters Patent, No. 894—1852.

Mr. Henry Cole, C.B., thought Mr. Bennoch, in endeavouring to bring others to the point, had wandered from it himself. He apprehended the object of the author of the paper was to discuss how far tramways were desirable wherever facilities existed for their introduction — without any special reference to the city of London. Mr. Bennoch had alluded to the state of things in Paris; but they must take the facts as they found them. Many gentlemen present had seen the railway from the Champs Elysées to St. Cloud, and had probably travelled upon it with comfort and cheapness, and he saw no reason why the same system should not be adopted for the convenience of the inhabitants of London, in such localities where (as was the case in Paris), there were facilities for its introduction. Mr. Bennoch appeared to regard the question as one peculiarly affecting the city: such, however, he apprehended was not the idea of the author of the paper. It might, with some force, be argued that the steam-boats, running on the river, were of no use to persons wishing to go to the Bank; and, in like manner, the argument might be extended to the Greenwich boats, or the London and South Western, or any other of the metropolitan railways. They do not take people to the Bank, or into the heart of the City. The gist of the paper was, that a system of railways, other than those worked by locomotives, was applicable to the traffic of London, and that was a position which had been proved practicable in Paris. If they wanted such a means of transit to the Crystal Palace, for example, and they started from Blackfriar's-bridge, was it of no value because it did not lead to the Bank? Whether due provision could be made for the accommodation of the heavy commercial traffic was another question, which he could not enter upon, nor wa he competent to express an opinion on the engineering part of the question. He agreed with Mr. Bennoch, that if they looked at the great question of the general internal traffic of London, it must be in connection with the embankment of the Thames. Every one who traversed the river must be struck with the facilities there presented for converting the noisome mud-banks into a grand highway. It was marvellous to see capital seek-

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* Traffic over London Bridge.

	1 day in 1850.	1 day in 1853.	1 day in 1856.
	Vehicles.	Vehicles.	Vehicles.
9 to 10 o'clock..	1,128	1,311	1,220
10 ,, 11 ,, ...	1,332	1,248	1,574
11 ,, 12 ,, ...	1,224	1,373	1,625
12 ,, 1 ,, ...	1,094	1,288	1,465
1 ,, 2 ,, ...	1,058	1,185	1,455
2 ,, 3 ,, ...	1,101	1,092	1,282
3 ,, 4 ,, ...	1,180	1,265	1,451
4 ,, 5 ,, ...	1,344	1,426	1,545
5 ,, 6 ,, ...	1,308	1,310	1,502
	10,769	11,498	13,119

ing its development in every quarter, whilst that great scheme of embankment was allowed to remain at rest; and it was surprising that there was no dominant will to say, We will turn this to account, and improve both the river and the facilities for the vast traffic of London. If Mr. Bennoch had a mission to advocate—the embankment of the Thames—he (Mr. Cole) was sure he would meet with a hearty concurrence from this Society, and then they might entertain Mr. Adams' plan of tramways also. If they could only get a tramway from St. James's to Kensington, or any places of great public resort, he thought it a matter not unworthy their notice.

Mr. Vignoles remarked that the question of the embankment of the Thames was one in which he had no doubt they would all concur, but there were a vast number of interests—which in this country they were accustomed to regard—to be consulted, as well as engineering considerations of the utmost importance, such as the question of the flow of the tide, and other matters. which would have to be settled before the dominant will could carry that scheme into operation. After due discussion of these points, he had no doubt they would arrive at an unanimous opinion in favour of the embankment of the Thames, as affording a better mode of access through London. There was no person who admired more than he did the talents of Mr. Bridges Adams. There were very few engineers in the present day who had not in some way or other benefited by his vast energy, his indomitable perseverance, and the liberal manner in which he had dispensed his ideas, and devoted his health and fortune to the advancement of the mechanical details of railways. With respect to the practicability of the plan, no doubt it was perfectly practicable in itself. The result in Paris was a sufficient proof that such a thing could be done, and that it could be done in thoroughfares of moderate width, so as not to interfere with the ordinary traffic. It certainly could not be attempted in the heart of the city, but in the outskirts it could. Indeed, it had already been done along the Commercial-road, where it was continued up to Church-street, Whitechapel, at which point the road was too narrow for its further extension. The same system had been adopted throughout the whole extent of the docks at Liverpool without interference with the other traffic of the locality, and whole trains of waggons were conveyed by that means; therefore, the practicability of the principle must be admitted. But there was another element which, he thought, had not been sufficiently adverted to. It was not enough to have a railway, but they must put rolling stock upon it, which involved in some degree a change in the particular mode of conveyance; and before the public would fall in with the new system there must be a sufficiency of rolling stock to afford the same accommodation to the public as at present existed. That, he thought, would prove the real stumbling-block to the successful introduction of this system of urban railways. because, to get a large trade there must be accommodation afforded at the very moment it was required. This would involve a considerable amount of capital for rolling stock. With regard to the cost of the road itself there were a great number of points to be considered. One gentleman had alluded to the gas and water pipes. Such a question was more pertinent to London than to any other place, and reduced itself into a question of annual expense in the way of maintenance, for he doubted whether Parliament would sanction the imposing upon gas and water companies the additional burden of repairing the railways as well as the highways which they disturbed. He doubted whether the system could be carried out without the sanction of an Act of Parliament. The cost of the road, taking the experience of Liverpool and Paris, he thought would be beyond what Mr. Adams had put it at; but, after all, it would not be very considerable, though the cost of maintenance, he thought, would be an item of some importance.

Mr. M. H. Perley said, he was in the habit of visiting many of the large cities of the States, and had freely availed himself of the comfort of horse railways in New York, Boston, Philadelphia and Baltimore; and he was sure those who had travelled by the horse railways would not wish to go by any other mode of conveyance. It was quite true that these railways could only be used in such situations as not to interfere with the other traffic in the streets. The carriages in New York ordinarily conveyed twenty-four persons inside. The streets of Boston more resembled those of London as to width, than those of New York or Philadelphia, but the system had been successfully introduced there. With reference to keeping the track clear, he thought the difficulty was greater in America than would be the case here, because of the greater quantity of snow; yet he could state that the horse railways had continued to work when the other vehicles had been stopped by it. In fact, in all respects, these horse railways had been found a great convenience.

Mr. Aston said, that as far as his experience, during a short visit to the United States, enabled him to form an opinion, he thought the system of street and horse railroads appeared to answer admirably there. He had seen them at work in streets that were not very wide, and where the difficulties of ascent and descent were easily overcome, and where sharp turns round corners were made of little account. With regard to two main objections, which had been stated as operating against their introduction here, the difficulty of providing for frequent stoppages, and the danger of turning round sharp corners, the first was overcome in America by the use of powerful brakes, which placed the common street cars, and even large railway cars, containing sometimes as many as sixty passengers, perfectly under the control of the conductor, who could stop the vehicle in a short time, even when on a moderate descent. But it was not always necessary to stop the car; the motion was so even, the cars so roomy, and the steps for descent so well contrived, that a passenger might alight with safety while the carriage was in motion. Indeed he (Mr. Aston) had done this himself when in New York. With regard to turning sharp corners, the flanges of the wheels ran in grooves, and, on turning a corner, the outer groove was replaced either by a flat plate or a raised tramway, so that the off-wheels of the car ran on their flanges, and were, more or less, raised according as the sharpness of the turn rendered it desirable. This inward inclination of the carriages counteracted the centrifugal tendency of the weight, and so the balance was preserved. He (Mr. Aston) quite agreed with what had been said about the comfort and convenience of the roomy carriages, as used in America. For ladies they were all that could be desired, and there was no doubt but that, in this country, the unfortunate "unprotected females" would find great comfort from the adoption of a system which their Transatlantic cousins found so convenient.

In reply to an inquiry, Mr. Hobbs stated, that the gradient down the Bowery in New York was about the same as that from Charing-cross to the Horse-guards.

Mr. Lacey thought very highly of the plan for working small branch lines of railways, but questioned the possibility of its introduction in crowded streets. He saw no reason why such a road should not be carried from Westminster-bridge, or any other of the bridges, to the Crystal Palace: but he thought it could be done only under the sanction of an Act of Parliament.

Mr. Hyde Clarke reminded Mr. Adams that the Whitby and Pickering Railway was worked by horses, as well as several of the German lines, until a higher speed was required.

Mr. Bridges Adams, in reply to the observations advanced, said it had never been contemplated by him to cover all London at once with this system of railways—nor did he think it practicable to introduce them into narrow thoroughfares, although perfectly practicable in some localities. He thought, as regarded the traffic of

London, they would ultimately have to make streets on the first floor—the first floor for the light traffic, and the lower level for the heavy traffic. With regard to the railway itself, he looked upon it only as another mode of paving, and a strip of iron rail passing down a street would occasion no more obstruction than the iron gutters through the pavement to carry off the water from the houses. With regard to the rails, there was no occasion for a deep channel—a very small one would suffice to keep the wheels in their place. He believed the plan needed only to be seen in operation to be appreciated, and his object in the present paper was to draw attention to the subject. He thought it desirable that it should be tried over a short distance, and when proved to be practicable there would be no difficulty in following it up. He saw no reason why the experiment should not be tried in such thoroughfares as Oxford-street or Holborn. With regard to stopping the carriages at any required moment, there was no difficulty in adopting mechanical appliances to effect that object. He thought the rails ought to be laid upon the simplest plan, so that a length requiring to be replaced could be removed with facility. He thought the cost of repairs would be small. The load upon the rails would be so much less than that on ordinary railways, that the abrasion of the rails would be very slight indeed.

The Chairman said they were very much indebted to Mr. Adams for having brought this subject forward. There was no doubt it was an important subject, and one on which much difference of opinion would naturally exist, but he thought they could not fail to be struck with this fact, that the state of things in a comparatively new city like that of New York, or in a new country like the United States, was very different to that which existed in this metropolis. Nevertheless they ought to take a lesson from their American friends with regard to these horse railways and the carriages on them as well as with regard to the way in which these tramways were connected with the locomotive lines. Such an experiment might be very fairly tried from the Strand over Hungerford Bridge to the South Western Railway, to which he would direct the attention of his friend Mr. Lacey. He agreed with Mr. Bennoch that the effectual relief of the great traffic of London would be found in the embankment of the Thames. He hoped this would not be the last occasion on which this subject would be discussed by this Society. It was one to which they might turn their attention with advantage, and he hoped before long they would see some means adopted by which the communications between the metropolis and the suburbs might be materially improved. He begged to propose a vote of thanks to Mr. Adams for his paper.

A vote of thanks to Mr. Adams was then passed.

The Secretary announced that on Wednesday evening next, the 18th inst., a Paper by Mr. J. N. Hearder, of Plymouth, "On a Powerful Modification of the Induction Coil and some New Electrical Phenomena Developed by it," would be read.

EXAMINATIONS OF THE SOCIETY OF ARTS.

(From the *Daily News*.)

The Registrar-General, a public functionary who tells the most astounding truths with a provoking calmness which is to the last degree irritating, has just made us acquainted with the fact, that the natural increase of the population last year "was probably at the rate of 1,000 a day." Of these increments to the population it may be doubted whether one in a hundred accomplished the feat of entering the world with a silver spoon in its mouth, signifying that its rich soup was already prepared in advance, and that it was provided with all proper means for sipping it with decorum. A larger proportion might possibly have come furnished with wooden ladles in anticipation of a plentiful supply of modest porridge awaiting them at life's table. A great majority, however, were ushered into the world with their mouths unfurnished even with teeth. These will in after life have to look sharply around them to get either soup or porridge, and it must depend upon their own energies and training whether they are ever able to pick up crumbs enough to strengthen them for the battle of life. In other words, of the thousand human beings who were added to the population this morning, the vast majority will have to battle hard to obtain a living.

Now, it is pretty nearly agreed upon by all parties, that mere energies will do as little in the metaphorical battle of life as in any real battle. Energies are nothing unless they are disciplined and trained. Our spoonless and ladleless population will only have a chance of obtaining either spoons or ladles by groping painfully in the mud, like the *chiffoniers* at Paris, unless they prepare themselves for something higher. And as ninety-nine out of a hundred of your *chiffoniers* never light upon a spoon or a ladle in the gutters of society, in spite of the most anxious search, they occasionally endeavour to supply themselves with these articles in a manner that is scarcely consistent with a proper degree of reverence for the eighth commandment. In other words, they lay society under contribution for their support. So that of the thousand British subjects who have made their entrance into the world to-day, there is no knowing how many may be occupied this day twenty years in garotting by day and committing burglary by night, unless you furnish them by education with the means of playing a more decent part in society. All parties are tolerably well agreed upon this point. Conservatives and Liberals, pious men, and men of the world, nobles and tradesmen, all concur in asserting the absolute necessity of national education. You cannot take up a daily newspaper without seeing overwhelming testimony to the magnitude of the need, the universal conviction that something must be done. Take the other day's *Daily News* as an example. We read there of the Bishop of London, Mr. Gladstone, Mr. Maurice, and others, declaiming on education at Stepney. We learn that on Friday an Educational Conference took place at the Athenæum, Manchester. Finally, we hear that Dr. Booth has been addressing the guests at a large Soirée held in the Hall at the Mechanics' Institute at Nottingham, on the subject of the Society of Arts' Examinations. We might almost be induced to suppose that grown-up people were subscribing heartily to the belief in the proverb to which they listened rather impatiently in their childhood:

When house and lands are gone and spent,
Then learning is most excellent;

and that the Latin dictum *Rem quocumque modo Rem* would be translated by "Education at any price."

But in spite of the universal feeling in favour of a national education we are as far from it as ever. The Voluntaries denounce fiercely the system of government grants. The advocates of state education sneer at the assertion that education on the voluntary system is possible. The friends of religious education treat the friends of secular education as heretics, and the latter accuse their opponents of imbecility. If the whole nation were to agree to-morrow that it was expedient that education should be undertaken by the State, a generation would be born and die before the details could be agreed upon. We doubt whether it would be possible to form a cabinet of efficient men who would agree upon a definite plan of state education. The Committee of Council itself may be regarded as a standing proof of the impotence of government in the matter of education. Almost the whole of its operations are confined to the assistance by grants of money of private and local efforts, and the appointment of inspectors, whose duty it is to see that he purposes for which the grants were bestowed are carried out. The object of the Committee of Council is not to educate, but to assist those who are engaged in education. And this is the limit of the agency with which government will be entrusted in the matter of education. And, even if there were a desire to give the government rather more power, there is every possibility that fear of the consequences would deter the public from fulfilling the desire. The government, as recent events have proved, seems to have lost the power of organisation. It plunges rashly into enterprises of moment without any knowledge or skill, content to gain information by the rough process of loss and misfortune. The great movements of the time, such as the reformatory system, have taken place outside of government, which is content with the subordinate part of assisting, by money and protection, the development of that which has originated elsewhere.

It is not, therefore, to be wondered at that education should not form the subject of a special notice in the Queen's Speech. The educational bodies are, in many instances, doing their work well, and it would be a pity that they should be interrupted, at least at present, in their operation by a government measure. At the same time, it would be as well that bodies which are working without any bond of co-operation, any feeling of union, should have some common centre to which their labours might tend. A centralisation which should make all these bodies travel precisely the same road would be mischievous, but such a want of system as would make them naturally diverge would be worse. If there is no union amongst our educational institutions, there should at least be unity of aim. Although the methods may be different, the end should be the same. And this can only be attained by instituting a universal system of examinations, by which the qualifications of pupils educated in all classes of schools may be tested. This is precisely the system adopted in our great Universities. The pupils are educated in different colleges, under different systems, by different tutors, but they are all bound at the termination of their course to undergo the University examinations.

The only attempt to do for the pupils of the ordinary schools of the empire what the University do for the students in the colleges has been made by the Society of Arts. They have instituted examinations at which, under certain restrictions, pupils from the lower and middle-class schools may attend and have their qualifications tested. Certificates are granted to those who pass satisfactory examinations. The need of such a system was shown, previously to its being put into action, by the fact of a declaration being signed by a large number of merchants and manufacturers, stating that they should consider the possession of the Society's certificate by an applicant for a situation as a valid testimonial. The same thing was shown by the immediate adhesion to the plan of a great number of the most distinguished friends of education of all religious parties and of all sects. These persons, who would have debated for a quarter of a century without coming to any satisfactory conclusion as to the establishment of a system of education, were not only willing, but eager to join a plan having for its object the application of a test of the value of the results of education. It may or may not be a question for discussion whether children should receive religious instruction under the same roof where they prosecute secular studies, but there can be no doubt that it is expedient to know whether this secular education has or has not been a sham. The best test of the reality of this education is an examination. And this test may be applied with more impartiality and accuracy by parties who have not been concerned in the education of those they examine than by the educators themselves. If the Society of Arts can extend their operations, hitherto conducted with so much success, throughout the whole of England, they will have gone far to establish a middle-class university. Detached from the processes of education, and only occupied with testing its results, they will be looked upon without suspicion by all sects and denominations. The inducements they hold out to masters and pupils to exert themselves will have the effect of stimulating education in a remarkable manner. They will do this without requiring grants for school-houses or professors. If, however, they wish to steer clear of difficulties, they should preserve their present freedom from Government control. At present they have the confidence of the country; if they surrender the management of their scheme into the hands of Government, the public will involuntarily think of jobbery or disorganisation. They have obtained the confidence of the public by their intelligence and independence. If they give up one, the public will be loth to give them credit for the other.

THE SOULAGES COLLECTION.

After having been submitted to public criticism at Marlborough House since the 7th of December, the exhibition of this collection was closed on Saturday, 7th of February. During this period it has been visited by upwards of forty-eight thousand persons, which is just double the usual numbers attending at this season. Among these visitors as many as five thousand one hundred and twenty-six persons have paid for admission, being ninefold the average numbers paying. It is understood that the offer of sale has been made to the government for £13,620, with the recommendation that, if bought for the nation, it may be sent to Manchester.

The following is the report of the committee appointed by the council of the Royal Institute of British Architects to examine the Soulages Collection, and report their opinion whether it would be expedient to recommend its purchase by the Government:—

"The enlarged views in regard to architectural decoration which have recently revived the taste for ornamental design that some centuries ago was so prevalent in England, render it necessary for the architect of the present day to enter upon new fields of study, to seek for new sources of inspiration, and to acquaint himself with all the formulas of conception to be found in the productions of other branches of science and art than those which are directly structural, in order to qualify himself to take that lead in directing public taste which his position and vocation call upon him to assume. It is indisputable that in every age the sources of design for all classes of manufacture have been identified with the productions of the architect, and frequently derived from his conceptions. Among the ancients the fictile vases and the bronzes may be quoted in illustration of this fact as constantly borrowing their ornaments from the buildings of antiquity; and in the mediæval period the pillars, the buttresses, the carving, the panelling, and architectural divisions, all of which were applied to fittings of every description, were adopted from the structural details of the edifices, often with little or no reference to material or other proprieties of adaptation.

"As the architect's development of the artistic element is the highest applicable to the common purposes of life, it is obvious that the revival of obsolete sources of decoration demands the utmost circumspection. To acquit himself conscientiously of such a responsibility he must neglect no means of information—he must underrate no style, no object, no department, which may contribute to those harmonious effects which it is his province to endeavour on all occasions to insure. He must enter upon a new career of thought, and acquaint himself with the history and fluctuations that have distinguished each phase of the origin, development, and decay of every class of applied ornament; so as to adopt it with propriety, taste and originality, as an ever fresh idea, and not as a mere 'rifacciamento' of existing forms.

"Collections like those of M. Soulages and of the late

Mr. Bernal are of the utmost value to the architect, reflecting as they do the arts, manufacture, skill, and taste of various countries and periods; and showing their application to the ordinary uses of life in the several grades of society. No less remarkable are they when set in contrast with the industrial practice of the first quarter of the present century,—a period of singular barrenness in technical design, since they serve to bear only a more vivid testimony to the extent to which art was applied in the most trifling and ordinary utensils and objects, during those palmy days of Italian grandeur when were executed the majority of the specimens of which those collections consist. During such periods the sentiment of art would appear to have been absolutely necessary to commend the productions of the skilled mechanic to general acceptance. And it is remarkable to observe that taste never became the exclusive property of any one department or class of productions, but reigned an universal element, the decline of purity in any manufacture being but the sign of a general and concurrent deterioration in every other. Such collections represent a world-wide school, in which to form an universal rather than a particular standard of national taste; and thus the student is freed from the trammels of that confined view of style which the traditions of any one period, limited within a narrow geographical circle, would bind around him. France, Italy, Germany, and England, have furnished their quota of excellence in many ways to the specimens now brought together in Marlborough-house; and from the very distinctive peculiarities which characterise the various productions, a wider field is afforded for the wares of the manufacturer of the present day, fresh tastes are excited, and an earnest longing is created in the purchaser for the possession of more refined and excellent productions; raising them above mere mechanical results, enlarging their sphere of application and necessarily stimulating production.

"There can be little healthy progress in national manufacture so long as the commonest and mere material wants only have to be satisfied; but directly cultivated taste seeks for superior execution and more refined elegance, enterprise and skill are enlisted in the gratification of those tendencies, progressive improvements constantly arise, industry and commerce gain by the movement, and the material prosperity of those engaged therein necessarily follows.

"ENAMELS.

"There are many arts which once flourished in this country, and which have been applied only in a very limited manner within a century or two, while there are others which have never received in Great Britain the development of which they are capable, and which in other countries have been productive of very important results. Enamelling was at one time extensively used in England, as we may see on the metallic monuments in Westminster Abbey, some of the recumbent figures of which were covered with elaborate ornaments of this nature, as also the heraldic shields occasionally inserted in brasses. It is now almost entirely confined to smaller works of the jeweller's craft, or elaborate reproductions of choice pictures and portraits; whereas in the Bernal and Soulages collections are to be found medallions and plates of considerable dimensions, and the art applied to tazze, inkstands, and salt-cellars, enriched with most delicate arabesques and historical subjects. Such specimens give renewed hope that we may ultimately realize at moderate cost the process of enamelling on slabs of lava, brought under the attention of this institute some years since by an honorary and corresponding member, M. Hittorff, now president of the section of fine arts of the Institute of France, or medallion portraits of a nature somewhat similar to those introduced in the *façade* of the Academie des Beaux Arts at Paris by M. Duban. There seems no reason, if public taste afforded the encouragement, why enamelled panels might not be successfully introduced as an architectural decoration, durable as to material, brilliant in colour, and unchangeable in effect. A notable instance of such an application of enamel existed in the famous Chateau de Madrid in the Bois de Boulogne, Paris, which has been the theme of praise by all writers who have mentioned it. The *façade* was adorned with enamels 5 feet high by 3 feet 4 inches wide, nine of which still exist in the Hotel de Cluny.* Were such panels capable of being multiplied at a moderate cost, we might from time to time introduce in our buildings a series of all but imperishable portraits of our sovereigns, of eminent men and historical characters; not, as in past times, confining the subject of such enamels to the twelve Cæsars, the labours of Hercules, or such pedantic abstractions, but adopting themes from our own poets, writers, and historians; and these would come more home to the feelings, and commemorate for popular honour and respect those celebrities who have illustrated our own history, and have rendered eminent services to our country.

"MEDALS.

"Medal die engraving is at present of very restricted application, being generally limited in this country to too small a class of objects; and little patronage is bestowed upon what was among the ancients, and after the revival, a most important department of art production. The medals and coinage of antiquity are upon a par with the productions of Phidias, Lysippus, and Praxiteles; and the coins of Sicily and many towns of Greece, the medals of Alexander and his successors, as well as the Roman Imperial series, reflect the genius of the brightest eras of antique taste and skill. Of scarcely inferior merit were the Italian medals; and the medallions of various sizes—whether cast or struck—of the 15th and 16th centuries are full of intense meaning, handing down to us, with the utmost vigour and refinement of expression, the lineaments of the great, the noble, or the illustrious of those periods.

"Of such gems the Soulages collection contains 106 specimens, chiefly of Italian and French art, struck or cast, presenting many varieties of treatment, and suggestive of an useful application of such memorials in modern times, combining valuable æsthetic results with historical records of an almost imperishable nature.

"GLASS.

"The brilliant progress which has been made in the manufacture of glass in this country within the few years that have elapsed since the removal of those fiscal restrictions which arrested all improvement and threw this country behind others invests the articles of this class in the Soulages collection with great interest. Without entering into the technical processes of the 'laticino,' 'vitro di trina,' 'millefiori," 'aventurine,' and 'schmelze,' some of which are already practised in England, we may at once confidently predict that the study of choice specimens like those presented to view in Marlborough-house will lead to the development of new combinations, which will some day distinguish our English manufactures as much as, if not more than, their Italian or Bohemian predecessors. The rapid advance in the scientific manufacture of glass, and the new applications of that material which have recently been brought to light for the supply of architectural requirements, are alone sufficient to convince us that this art is capable of the utmost development through English enterprise.

"BRONZES.

"The 106 objects in bronze comprised in the Soulages collection illustrate a class of manufacture hitherto of very limited application in England; whereas in her Eastern dependencies the artists in bronze for centuries past have produced, even in common utensils, elegance of form and unrivalled decoration in metallic inlay. This latter elegant process, which was of essentially Oriental origin, was eagerly adopted by the Venetians, and reproduced in their Damascened ware.

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* It is said that some were purchased by Englishmen, and are now in this country. It would be a great service to the arts if they could be discovered, and exposed in the Great Exhibition about to be opened at Manchester.

" Tens of thousands of French artisans are maintained by their skilful treatment of bronze, now an essential article of furniture in that country, and purchased with avidity in England and, indeed, throughout Europe and America. So unpractised are our founders in the successful casting of such delicate objects, and so deficient are we in educated chasers and finishers, that we have to depend mainly on foreigners for the supply of small bronzes. Their production by English manufacturers is, indeed, so costly that the Art-Union of London (who for many years devoted much attention to the subject, and at great expense brought out various statuettes and busts), anxious as that body are to encourage the art, have been almost compelled to abandon the attempt to any great extent, and only persevere under the most discouraging circumstances. The beautiful works of art in bronze, so abundant in Paris, find no rivalry here. And we feel, therefore, that the acquisitions of the specimens in this collection, although far too limited for the urgent necessity that exists for the supply of good models in this branch of industry, would be desirable, as tending to draw public attention to this important and neglected branch of art manufacture. We do not venture to class them in design or execution with the matchless productions of antiquity, such as those preserved in the Museum of the Studii at Naples, or even with modern ones of the highest class of art; but still there are many objects gracefully composed, elegant in form, and especially suggestive of improvement in those departments of domestic economy into which they might be introduced with propriety.

" Decorative Furniture.

"There are 100 pieces[*] of furniture and textile fabrics, consisting of chairs, cabinets, coffers, tables, buffets, dressiors, metallic mirrors, a magnificent lantern, the cornice of a room, three pairs of bellows of tasteful design and execution, and an elaborate chimney-piece. These present a store of useful and applicable articles of various merit. Some few are carved with considerable skill, others are distinguished for their general design or graceful proportions. Some have been considerably repaired or modified by inferior hands, but others remain intact. The buffets and armoires are suggestive, and admit of easy application to our present uses. The chestnut-wood coffers, the marriage-chests of Italian history and romance, have evidently originated in a superior class of artists, and the metal mirrors, with their carved frames, are graceful illustrations of a curious variety of domestic utensils. In all these articles it is necessary to discriminate between the production of the manufacturer who repeats, and the treatment of his material by the artist who originates. We may still be enabled to recognise clearly those forms and expressions of original ideas, vulgarised by the common taste of those who repeat or demand repetition; for, although coarse in parts or gross in detail, they may still retain some of the elements of that antecedent period when livelier imagination, more refinement, and truer sentiment prevailed. The textile fabrics contain some very elegant ornamented patterns, and several curious specimens of embroidery.

" Majolica.

We have reserved for our concluding remarks the most numerous and most important section of this collection —namely, the majolica, and enamelled earthern and stone wares, consisting of 168 pieces.[†] We shall not enlarge upon the mutual relations of art and material, nor upon the extent to which all branches of fine art are influenced by the materials employed. This is especially perceptible in the earthenwares of Greek art and majolica, in contrast with the porcelains of Asia and Europe, and their works in this class are as distinct as the earths of which they are composed. Nor do we pretend to review the various processes of manufacture, nor the mysteries of the glaze and brilliant lustres which give so much attraction to these admirable productions, such as the metallic reflexions, the changing colours, the mother-o'-pearl of Gubbio, Urbido, Pesaro, Caffagiolo, Faenza, Castel Durante, or of other towns or States of Italy, where the enlightened patronage of the dukes and princes to these wares realised a reputation that could hardly otherwise have been acquired by places of such secondary importance. The earlier pieces of majolica retain much of the noble simplicity of form and richness of decoration of their Hispano-Moorish origin; and the later ones have a higher aim than the porcelains of Germany and France, whose art decorations occasionally present a fantastic and capricious application, and generally a minute and highly-wrought elaboration by superior artists, almost too precious for the frail material upon which it is bestowed, limiting the products to the tables only of the most affluent.

" The majolica, on the contrary, admits, when once the design is settled, of a rapid execution by practised secondary hands; by this economy in the production most carefully designed objects may be brought within the means of the humbler admirer of art. This series includes some choice specimens[*] of Bernard de Palissy's skill, and embraces every class of object fitted for the table, or to adorn the buffet or dressoir; such as plateaus, plaques, vases, plates, fruttiere, tazze, trays or baskets, cups, flasks, bowls, ewers, sauceboats, saltcellars, and other articles. The finest of these are grouped in one case, and constitute a series of the highest æsthetic value, as regards their form, the combinations of colour, and treatment of decoration. They are available as types, or may be considered educationally as specimens to be followed, improved, or varied; there is not one which is not valuable for the one or other purpose. The success may be problematical of any attempt to derange the predilections and established favour with which the public have been accustomed to regard certain articles of use in common life; but we believe that the public mind is prepared and anxious to adopt a higher state of art-treatment in such objects. •

" Without advocating for a moment a blind adherence to any of these forms, or the modes of decoration which distinguish these works, in which occasionally the execution may not rise to the dignity of the subject—in which extravagance may now and then have usurped the place of good taste, and in which noble forms may be here and there applied to inferior uses—we may clearly recognize so much that is noble and brilliant, so much that is full of feeling and expression, and such an appeal to a higher intelligence as to warrant our maintaining distinctly that access to such examples must improve the taste of the people, and elevate the aspirations of every mind for something better than those we already possess. This consummation we are indeed justified in prognosticating (from the successful efforts in majolica made by the firm of Minton for the Paris Universal Exhibition of 1855) our own countrymen on the banks of the Trent and the Severn are fully able to attain. From those exertions we may reasonably contemplate that, in a few years by the teaching aid of such examples as those contained in the Soulages Collection, by the union of manufacturing skill in the manipulation with artistic power in the embellishment, and by due encouragement from the public, majolica will become in this country a most attractive and very important branch of art production, and eventually compete with the ceramic works of any period and of any country.

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[*] Artistic in general effect are 660, 670, 691, 693. Nos. 655, 656, are to be praised for their design and execution; and 670, 671, for exquisite design and workmanship.

[†] Very satisfactory in point of design are the arabesques around Nos. 1, 2, 4, 5. 7a, 7b, 7c, 28, 29, 35m, 38, 38r, 41, 43, 15k, 15h, 15l, 66, 72, 75, 76; and in form as well as in decoration, 86, 88, 92, 105, 108, 110; and as works of real art, 3, 6, 8, 9, 82.

[*] Very high in style of conventional ornament, in design execution, and effect, are 138, 142, 143, 144.

"In conclusion, we have to report that we are unable to contemplate, without the deepest regret, the possibility of such a collection being broken up and scattered into various channels. Each individual piece has its own peculiar value or merit; but when combined with others, as illustrating either the theory or history of art, so as to complete the chain and connexion of manufacture and art illustration, and thus forming a series of the progressive excellence to which such productions have been carried in times past, their worth is much enhanced. If Government were to rely upon the chances of a sale they would probably be outbid for the best articles by wealthy individuals, who will gratify a taste at a fancy price, and thus the museums of the nation would have in such an event only the chance of obtaining secondary articles, purchased at greatly enhanced cost.

"In making this report the committee have deemed it more advisable to submit their opinions, based, after a careful examination of the objects, upon a broad and general consideration of their importance as a whole, and as a commencement and very desirable contribution, with the series obtained from the Bernal collection, towards a large and complete historical and artistic museum, rather than a minute criticism of any individual specimens. And they have come to the conclusion that it would be an irreparable loss of a great opportunity to improve our manufactures, to enlarge the sphere of art application, to increase our commerce, and to instruct the public mind, if the Government did not accept the offer to sell the whole to the nation at cost price—an offer so nobly made by the disinterested and public spirited men who, with singular generosity, and on their own responsibility, have at all risks afforded the opportunity to the country of securing the collection in its entirety.

"T. L. DONALDSON, Chairman. "T. H. LEWIS.
"S. ANGELL. "A. SALVIN.
"A. ASHPITEL. "G. VULLIAMY.
"TALBOT BURY. "T. H. WYATT.
"BENJ. FERRY. "C. C. NELSON } Hon.
"E. I'ANSON "W. D. WYATT } Secs.
Jan. 1857.

Proceedings of Institutions.

NOTTINGHAM.—The annual *soirée* of the members of the Mechanics' Institution took place on Thursday, the 29th ult., in the great hall of the Institute. The chair was taken at seven o'clock, by Mr. J. E. Denison, M.P., the president of the Institution, who was supported on the platform by Mr. J. Walter, M.P., Mr. C. Paget, M.P., Mr. W. H. Barrow, M.P., the Rev. Dr. Booth (who attended from the Society of Arts), W. Enfield, Esq., the Mayor, Rev. S. McAll, B. Campbell, Esq., L. Haymann, Esq., and other gentlemen. The CHAIRMAN, in opening the proceedings, said, the town of Nottingham had been vastly increasing, but the question was, had the means of instructing the people kept pace with the increase of their numbers, and as far as this Institution was concerned, had it done all it could in its sphere to promote the advancement and instruction of the people. This was, perhaps, not the most suitable occasion for discussing the general question of education. He could not, however, avoid alluding to one measure, which provided that it should be in the power of the guardians to provide the poor children belonging to recipients of out-door relief with education. He was glad to find that this was being adopted. After speaking further upon the general question of education, he called upon Mr. W. H. BARROW, M.P., who proposed the following resolution:—"That this meeting, whilst it rejoices at the progress lately made in the cause of education generally, feels the necessity of continued and well sustained exertions to meet the growing and widely-spread demand of a rapidly increasing population." This was seconded by the Rev. S. McCall, and carried unanimously. Mr. J. WALTER, M.P., proposed the next resolution:—"That as Mechanics' Institutions form an important means for the spread of knowledge, intelligence, and improvement among the people, it is expedient, by wise and judicious management, to adapt them to the requirements of the times, and thus render them worthy of extended encouragement and support." He would read to them the evidence given some years ago before the Parliamentary committee, of which he was a member, by a gentleman named Warren, originally a working man, who attributed all the good he ever attained in his life mainly to his accidental connection with the Manchester Mechanics' Institution. Mr. Walter read extracts from the evidence of Mr. Warren, who, it appeared, was first struck by hearing a lecture on astronomy by Dr. Lardner, delivered in the Manchester Mechanics' Institution; and to the impetus produced by the impression which this lecture had on his mind he ascribed his subsequent advancement in life. Mr. Warren considered that the great value of Mechanics' Institutions was in directing the minds of working men to subjects which it would be of advantage to them to pursue. Mr. Walter observed, that if these institutions were to influence the working classes they must search out the working classes by connecting themselves with the schools of the working classes, for it was impossible that one central Institution could meet the wants of totally unlettered men, since it was only those who had received a certain amount of education who were capable of availing themselves of the advantages of these Institutions. He had a strong feeling that these Institutions, as generally conducted, had depended too much upon attaining an unnecessary popularity by the miscellaneous character of their lectures. A good library he considered to be the necessary basis of an Institution of this kind, and next to a good library he believed that classes for mutual instruction might be very beneficially adopted—classes, for instance, in which might be taught modern languages, mathematics, and other branches of art and science in which the working classes were most concerned. He (Mr. Walter) did not deny the advantage of lectures, but he thought that the conductors of these Institutions should obtain the services of men who were professionally devoted to that branch of literature, instead of seeking to attract an audience by the popularity, perhaps, of a member of Parliament, or some literary man, or any gentleman in the neighbourhood who might be, perhaps, good-natured enough to expose himself to the criticisms to which the *dilettante* lecturer was often very justly liable. Mr. G. PAGET, M.P., seconded the resolution. He thought if employers of labour made it a rule to prefer the man who could read and write, the working classes, finding that a value was set upon that accomplishment by employers, would begin to set a value upon it themselves, and would be stimulated to obtain instruction. It appeared to him that persons who employed men in whom mechanical knowledge was valuable might very fairly attach importance to a certificate of attendance upon mechanical classes in connection with institutions like this. Certificates might also be given to those who had attended the classes of modern languages, and no doubt such testimonies of proficiency in one or more continental tongues would be a valuable recommendation to clerks and others of that class. The hon. member then described the half-time system pursued, under his auspices, in the parish of Ruddington. His plan was, instead of employing four boys to employ eight, and on alternate days half of them worked in the field, and the other half of them went to school. Not only was their work done better and more cheerfully under this arrangement, but, according to the testimony of the schoolmaster, their progress in instruction was almost as great as if they were kept at school the whole of the week without intermission. In conclusion, Mr. Paget expressed his conviction that, however useful and entertaining lectures might be, the real work of Mechanics' Institutions must be done in the classes.—The Rev. Dr. Booth said, the attention which was now universally given to the great question of education, was most encouraging. He could account for the universal interest shown only in this way, that their exists a kind of national instinct, that without science, or a knowledge of God's external laws, we can no more make a satisfactory progress in temporal matters, than we can in spiritual things without a knowledge of his Divine laws. He believed that the opinion was gradually gaining strength, and deepening into a conviction, that in the same way as we cannot afford to leave our fields untilled and import corn, so neither can we much longer bear the cost of leaving the mind of this great nation uncultivated, to bear thorns and brambles. It was nothing to the purpose to say that our fathers got on very well without education. They did so for this reason, that the learning of that day, such as it was, had but little practical bearing on the affairs of daily life. But it was not so now. A common engine-driver on a railway, or an assistant in a chemist's laboratory, possessed an amount of knowledge that would have rendered even Newton still more illustrious. No man argued now against the paramount necessity of well-directed education and skilled instruction, any more than he would against steam navigation, or the railway, or the electric telegraph. But the solution of this great problem had been attempted in various ways. The State, the Church, and the great religious societies had attempted, but with very partial success, to solve the problem, and even if they had completely succeeded they would have left large masses of the population untouched. Now the Society of Arts had attempted to solve this problem in a very different way: and with respect to classes which had not hitherto been reached, to test the results of education, not to inquire into the modes by which it had been given; to stamp the gold when raised from the mine, not to inquire how or where it was raised. This plan of testing the value of the instruction given by means of examination had some peculiar features strongly to recommend it. One of the greatest was its facility of application. It could be brought into operation at once. It took the materials at hand, and set to work at once upon them. The Society of Arts proposed simply to extend to artisans and to the middle classes those advantages which the universities for years had been conferring on the upper and professional classes. The system of testing proficiency by means of examinations was now in full force in the civil service of the East India Company, in the Royal Artillery and Engineers, in several of the government departments, and the extension of this system of examinations was beginning to tell on the progress of education in the country. He would now reply to one or two popular objections against this system. It might be said examinations were not education. Undoubtedly this was true. They were only means to an end. But they supplied men with cogent motives to learn. They pointed out the direction in which the learner ought to proceed. But to a young man entering into business and commercial employment, it might be said by his master, true! this certificate of the Society of Arts bears testimony to your knowledge of Mathematics, or Chemistry, or English literature, or modern languages. But what of that; these things are of no value in my office. I want only very common-place information. But was not the acquisition of these branches of knowledge, in the face of privation, poverty, and hourly occupation, a test of the possession of industry, patience, energy, and perseverance. Were these qualities of no value. Though an employer might not want mathematics in his clerk, he might need the clear head which enabled the clerk to obtain that knowledge. Again it often had been said, the hope of a prize, a reward, or even a certificate was a low motive to hold out to men. You ought to dilate upon the intellectual pleasures of study. You should tell them that learning is its own best reward. But we found that the Almighty, even in this life, had made temporal rewards to wait upon integrity and well-doing, and punishment upon offence. Why had he not left them to carry their own rewards and punishments with them.—A resolution in favour of the Examinations was then proposed by the Mayor, and seconded by B. Campbell, Esq.—Votes of thanks having been passed to the Chairman and to the Rev. Dr. Booth, the meeting separated.

To Correspondents.

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Erratum.—In the last number of the *Journal*, page 173, col. 2, line 41, for "James Spiers" read "Richard James Spiers."

MEETINGS FOR THE ENSUING WEEK.

Mon. London Inst., 7. Mr. J. N. Hearder, "On Voltaic Electricity."
Chemical, 8. I. Professors Abel and Bloxam, "On the valuation of Nitrogen." II. Mr. R. Adie, "On Thermo-Electric Couples."
Tues. Royal Inst., 3. Prof. Huxley, "On the Sense of Touch."
Civil Engineers, 8. Renewed Discussion, "On the Permanent Way of Railways."
Linnæan, 8. Professor Owen. I. "On a new species of *euphectella* from the Seychelle Islands." II. "On the characters and subdivisions of the class *Mammalia*."
Pathological, 8.
Statistical, 8. Dr. Guy, "On the duration of Life among Lawyers."
Wed. Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. James N. Hearder, "On a new Electric Induction Coil."
Thurs. Royal Institution, 3. Prof. Tyndall, "On Sound."
Royal Society Club, 6.
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri. Geological, 1. Anniversary.
Royal Inst., 8½. Mr. C. Dresser, "On the Relation of Science to Ornamental Art."
Sat. Asiatic, 2.
London Institution, 3. Mr. T. A. Malone, "On Experimental Physics, chiefly in Relation to Chemistry."
Royal Institution, 3. Prof. Phillips, "On the Origin and Progress of Life on the Globe—Invertebrata."
Royal Botanic, 3¾.
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February* 6*th*, 1857.]

Dated 3*rd November*, 1856.

2580. Eugène Napoléon Cadet, 36, Rue Folie Méricourt, Paris—Improvements in the construction of cocks and taps.

Dated 23*rd December*, 1856.

3046. Alexander Ross, The Burn, Fettercairn, James Valentine, Woodmyre-cottage, Fettercairn, Alexander Murray, Fettercairn, and Alexander Don, Fettercairn, Kincardineshire—Certain improvements in the purification of coal gas, the residuum of such purifying process being applicable either as a manure or for manufacturing gas from.

Dated 20*th January*, 1857.

162. William Edward Newton, 66, Chancery-lane—Certain improvements in sewing machines. (A communication.)
164. Frederick Crace Calvert, Manchester—The use or application of certain substances in stiffening, sizeing, or otherwise preparing textile fabrics and paper.
166. Victor Augustin Keintzy, Paris—Improvements in machinery to be worked by steam or other power, for clearing and ploughing land.
168. Richard Quin, 65a, Poland-street—Improvements in stereoscopes.
170. Thomas Boyle, 1, Pilgrim-street, Ludgate-hill—Improvements in outside reflecting lanterns.
172. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for the preservation of money, books, papers, and other property, in case of disaster to ships and other vessels. (A communication.)

Dated 21*st January*, 1857.

173. Luke Duncan Jackson, Underwood, Nottinghamshire—An improved beer engine or syphon and vent peg, to be used for the purpose of drawing or pumping ales, beer, or other fluids.

174. John Massey and James Hargreaves, junr., Burnley, Lancashire—Certain improvements in machinery or apparatus employed in the preparation of cotton and other fibrous materials for spinning.
175. Henry Chamberlin, junr., Narborough, Norfolk—Improvements in implements or apparatus for ploughing, tilling, or cultivating land.
176. Eloi Jean Baptiste Ledure, Paris—An improved railway-break.
177. William Charles Scott, Waltham-cottages, Camberwell—Improvements in apparatus for separating coin.
178. Robert Ker Aitchison, London—Improved apparatus for the amalgamation of precious metals.
179. Samuel Dyer, Bristol—Certain improvements in ships' fittings, such as mast-hoops, jib hanks, and jib and other travellers.
181. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of lubricating compositions. (A communication.)
182. Samuel Neville, Gateshead, Durham—Improvements in machinery or apparatus employed in the annealing of glass and the firing of pottery ware.
183. Thomas Harris, Regent's-park—Improvements in apparatuses for refrigerating or cooling, and regulating the temperature in worts and beer, which may also be employed as condensers in distilling.
184. Alfred Vincent Newton, 66, Chancery-lane—Improved means of transmitting messages by audible signals. (A communication.)
185. Henry Cater, Anchor-terrace, Southwark—Improvements in steam boilers.

Dated 22nd January, 1857.

187. Leonard Bower, Birmingham—An improvement or improvements in the manufacture of bolts, rivets, spikes, screw-blanks, nuts for screws, and washers.
188. François Alexandre Nicolas Delsarte and Elisée Valin, Paris—Improvements in pianos and other stringed musical instruments.
189. James Warne, 3, Weymouth-place, New Kent-road—A new combination of metals applicable to decorative and useful purposes, part of which invention is applicable also to the method of combining metals and alloys of metals.
191. Elisha Mander and William Morgan, Birmingham—Improvements in the manufacture of photographic, jewellers' and other cases having wood or papier maché foundations, and where raised regular or irregular forms are required in such cases, and the machinery for carrying out such improvements, parts of which are applicable to other purposes where sawing or shaping is required.
192. Carl Christian Engstrom, Stockholm—Improvements in the construction of projectiles for rifled guns and mortars.
193. John Rubery, Birmingham—Improvements in runners, tap notches, and other parts of umbrellas and parasols.
194. Gustave Perez di Termi, 50, Friday-street—Improvements in the construction of artificial hands.
195. George Haden Hickman and Alfred Hickman, Bilston, Staffordshire—An improvement in the method of manufacturing strip and hoop iron used for making wrought-iron tubes and other purposes.
196. Ernst Luedeke, Raglan-terrace, Robin Hood-street, Nottingham—Improvements in obtaining power when steam, gas, or air is used.
197. Robert Johnstone, 2, Cambridge-place, Agar-town, St. Pancras—Improvements in the manufacture of firewood for lighting fires.
198. William Roberts, Millwall—Improvements in arranging ships' and other similar pumps.
199. Henry William Wimshurst, St. John's-wood—An improved mode of manufacturing sheet metal.
200. James Garth Marshall, Leeds—Improvements in preparing flax, hemp, China grass, and other vegetable fibrous substances.
201. Frederick Sadgrove, 2, Union-court, Old Broad-street—Improvements in the construction of window or other sashes or shutters and frames.

Dated 23rd January, 1857.

202. Abraham Hemingway and Thomas Wheatley, Openshaw, near Manchester—Improvements in slide valves for steam engines and other purposes.
203. George Bedson, Manchester—Improvements in coating iron and other metal with metals or metallic compounds.
204. Charles Frederic Vasserot, 45, Essex-street, Strand—An improved gasogene. (A communication.)
205. Charles Frederic Vasserot, 45, Essex-street, Strand—A hydrostatic bellows. (A communication.)
206. Charles Frederic Vasserot, 45, Essex street, Strand—An improved phosphoric fusee or tinder-box and lighter. (A communication.)
207. George Eskholme and Henry Wilkes, Rotherham—Improvements in ball or other cocks.
208. Peter Armand le Comte de Fontainemoreau, 39, Rue de l'Echiquier, Paris—Certain improvements in fire-arms, and in the bullets to be used therewith. (A communication.)
209. John Folliott Powell, 7, Albion-place, Hyde-park—Improvements in reverberatory and other furnaces.
210. George Fergusson Wilson, Belmont, Vauxhall—An improvement in the manufacture of night-lights.
211. Pier Alberto Balestrini, Brescia—Improvements in electric telegraphs.
212. George Fergusson Wilson, Belmont, Vauxhall—Improvements in the manufacture of candles.

Dated 24th January, 1857.

213. Thomas Ayles and Robert Andrews Ayles, jun., Weymouth—Improvements in the construction of ships and other vessels navigating on water.
215. John Whines, Pimlico—Improvements in machines for dovetailing, grooving, slotting, and rabeting.
217. Joseph Walton, Bradford, Yorkshire—Improvements in looms for weaving.
219. Daniel Green, Vauxhall—Improvements in potters' kilns.
221. Henry Bessemer, Queen-street-place, New Cannon-street—Improvement in the manufacture of iron and steel.

Dated 26th January, 1857.

223. François Constance, Paris—An improved apparatus for casting and finishing types and vignettes used for printing.
225. John Haile, Warren, Rhode Island, U.S.—Improvements in machinery for the manufacture of nails.
227. William Littell Tizard, Plymstock, Devon—Improvements in fermenting, cleansing, and attemperating apparatus to be employed in brewing.
229. Richard Archibald Brooman. 166, Fleet-street—A method of lubricating and preventing the heating of axles, journals and bearings in railway engines and carriages. (A communication.)
231. Francis Hamilton, Acton, Charles Burrell, Thetford, Norfolk, and James Boydell, Gloucester-crescent, Camden-town—Improvements in combining ploughs with locomotive engines.
233. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in sewing machines. (A communication.)

Dated 27th January, 1857.

235. James Stead Crosland, Openshaw, Manchester—Improvements in locomotive and other steam engines.
237. John Dangerfield, West Bromwich, Staffordshire—Improvements in the manufacture of chains.
239. George Leonard Doelling, 2, Rue Drouot, Paris—Improvements in machinery or apparatus for forming screw threads.

Dated 28th January, 1857.

243. John Elce and John Hewitt, Manchester—Certain improvements in mules and other machines for spinning and doubling.
245. Charles Whowell, Two Brooks, Tottington, Lancashire—Improvements in machinery for stretching, drying, and finishing woven fabrics.
247. George Cranstoun Trotter Cranstoun, Chirnside-bridge, Berwick, N.B., George Young, Dunse, and John Lovell, Chirnside-bridge—Improvements in generating steam.
249. Walter Henderson Sisterson, Southwark—An improvement in cranes.
251. Andrew Peddie How, Mark-lane—An improved anti-garotte cravat.
253. James Lee Norton, Imperial Works, Bromley by Bow—Improvements in steeping or washing and rinsing machines.
255. James Lee Norton, Imperial Works, Bromley by Bow—Improvements in separating animal from vegetable fibres.
257. George Fergusson Wilson, Belmont, Vauxhall—Improvements in treating Burmese and such like petroleum.
259. Henry Chamberlin, junr., Narborough, Norfolk—Improvements in paving or covering the surfaces of roads, streets, or ways.

WEEKLY LIST OF PATENTS SEALED.

February 6th.

1863. Samuel King.
1869. Thomas Austen.
1878. John Darlington.
1883. George Anderson.
1917. John Weir Draper Brown, and George Gibson Brown.
1929. Rd. Archibald Brooman.
1955. Thomas York.
1962. William Edward Newton.
2005. Rd. Archibald Brooman.
2006. Bernard Augustus Grautoff and Charles Henry William Albrecht.
2007. Thomas Watson.
2345. Simon Ghidiglia and Louis Turletti.
2206. John Underwood and Frederic Valentine Burt.
2411. Archibald Turner and Luke Turner.
2467. George Blair.
2821. Archibald Turner.
2951. Rafaello Louis Giandonati.
2957. H. Pease and T. Richardson.
2981. John Stobo.
3027. Daniel West.

February 10th.

1888. Nicholas Doran Maillard.
1894. David Lesser.
1895. Richard Dugdale Kay.
1901. John Knowles and William Clarke.
1924. William Tytherleigh.
1934. Pierre Noyer.
1953. William Akroyd and John Thompson.
2016. James Blake and Francis Maxwell.
2038. Pierre Joseph Guyet.
2094. Thomas Restell.
2345. William Wilkinson.
2358. David Joy and William Holt.
2585. Henry Bessemer.
2726. Henry Bessemer.
2813. Robert Griffiths.
2828. Laban Clarke Stuart.
2877. Laban Clarke Stuart.
2908. James Blain.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

February 2nd.

277. George Mills.

February 3rd.

302. James Taylor, Isaac Brown, and John Brown.

February 5th.

287. Auguste Louis Nicolas Comte Vander Meere.
300. Alphonse François Damiens Duvillier.

February 6th.

320. David Brown and John Brown.
332. William Whiteley.
347. James Cox.
369. George Fergusson Wilson.
377. George Fergusson Wilson.

February 7th.

297. Henry Olding.
326. James Young.